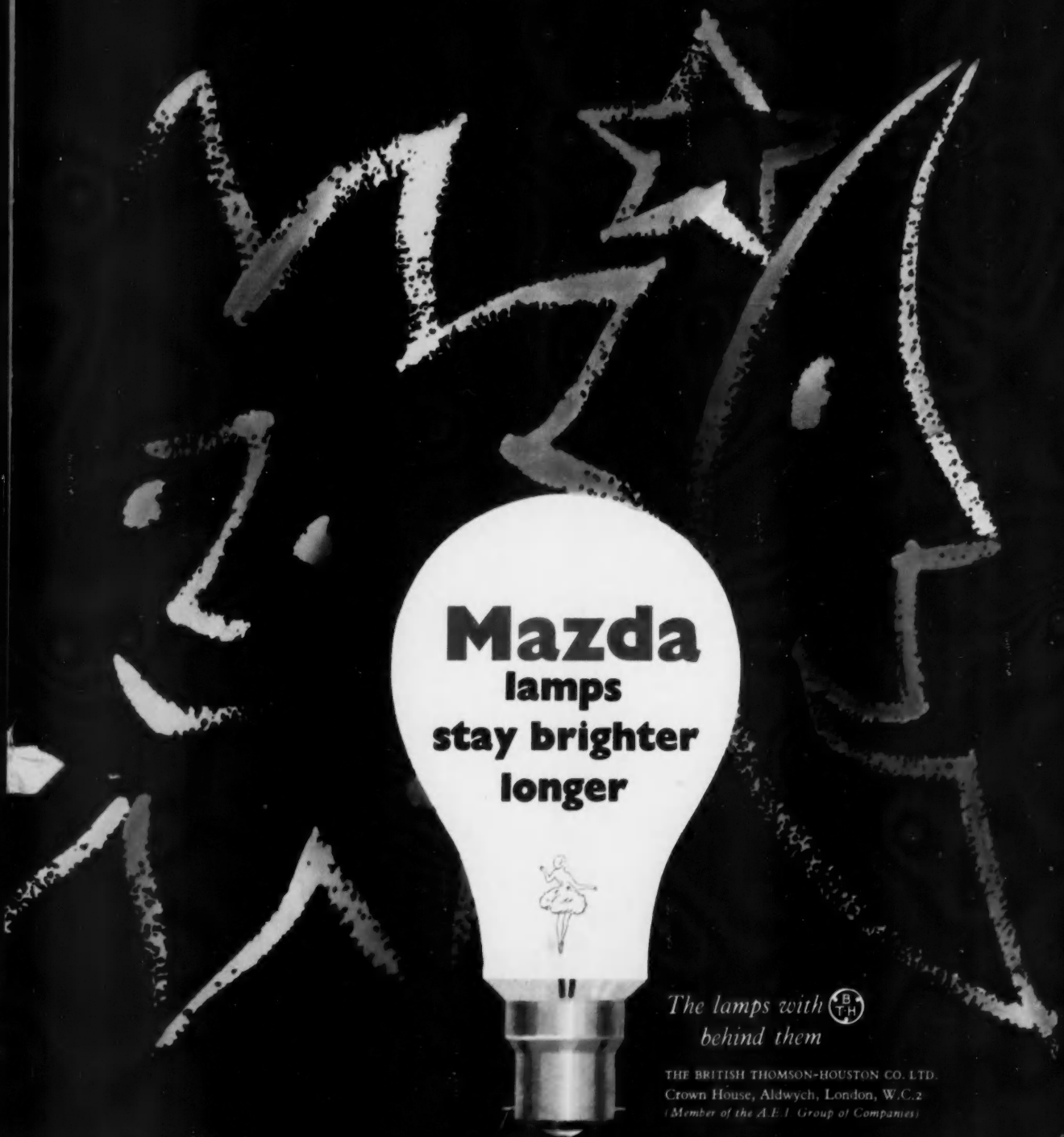
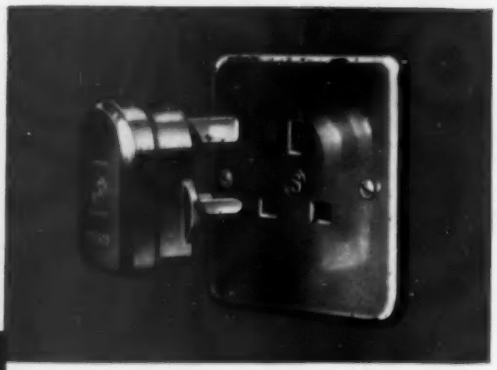
29 DECEMBER 1955

ONE SHILLING

ELECTRICAL TIMES

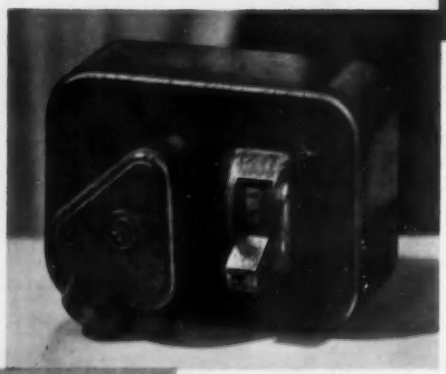


ACCESSORIES
for Better installations!



SAFETY SOCKET OUTLETS AND SWITCH SOCKETS

Domestic and Industrial



★ Every SANDERS product is the leader in its own particular field, backed by 60 years experience.

★ Quality, outstanding design, and attention to detail assure efficiency in service and long life.

★ **SPECIFY SANDERS FOR SATISFACTION**

and the well-tried
UNBREAKABLE PLUG

AND RESILIENT RUBBER FUSED PLUG

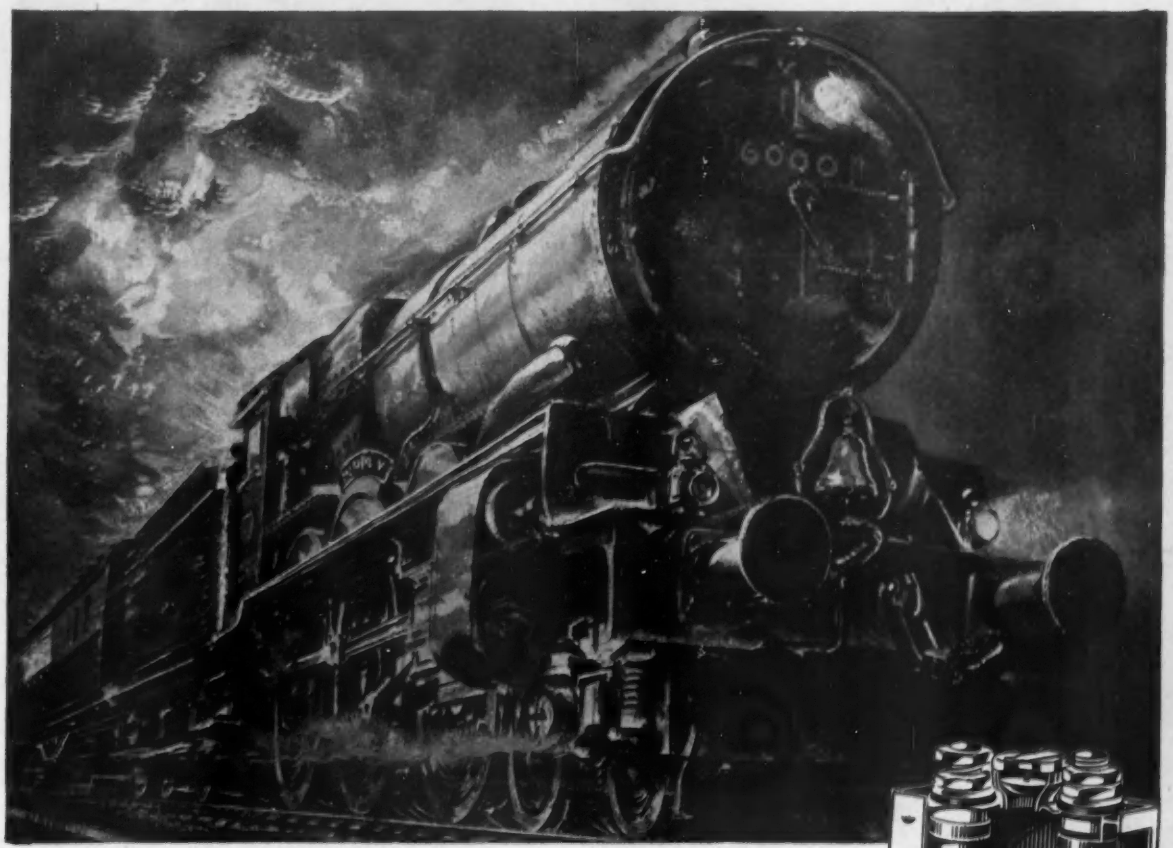
THE FAMOUS SANDERS CLOCK CONNECTOR

Write for Catalogue 155/55

SANDERS
WEDNESBURY

WM. SANDERS & CO. (WEDNESBURY) LTD., WEDNESBURY, STAFFS.

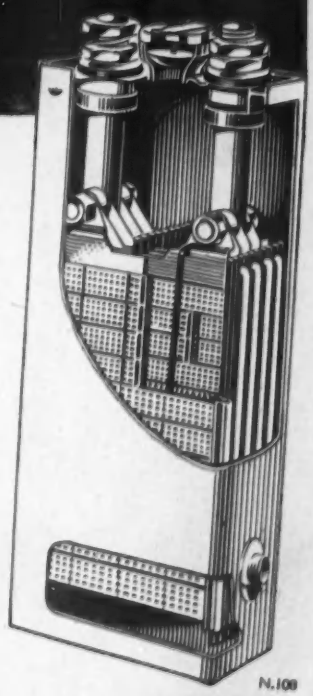
Which battery is built like the King George V?



Its name is Nife! This exceptionally tough battery is also made of steel and like the King George V is built to last—to withstand shock and vibration and to stand up to severe mechanical conditions. Unlike this giant locomotive, however, a Nife battery is small and compact, takes up very little room and requires virtually no maintenance. Also a Nife battery withstands the heaviest discharge, is free from self-discharge and is unaffected by idleness in any state of charge. *It repays its original cost many times over!*

These are the reasons why so many electrical engineers rely on Nife Batteries for:

SWITCH CLOSING · SWITCH TRIPPING · EMERGENCY LIGHTING
STANDBY POWER FOR AUXILIARIES AND CONTROL CIRCUITS
SEARCHLIGHT AND INSPECTION SETS · DIESEL ENGINE STARTING
PORTABLE SAFETY LAMPS · TELECOMMUNICATIONS
BATTERY ELECTRIC TRUCKS AND LOCOS

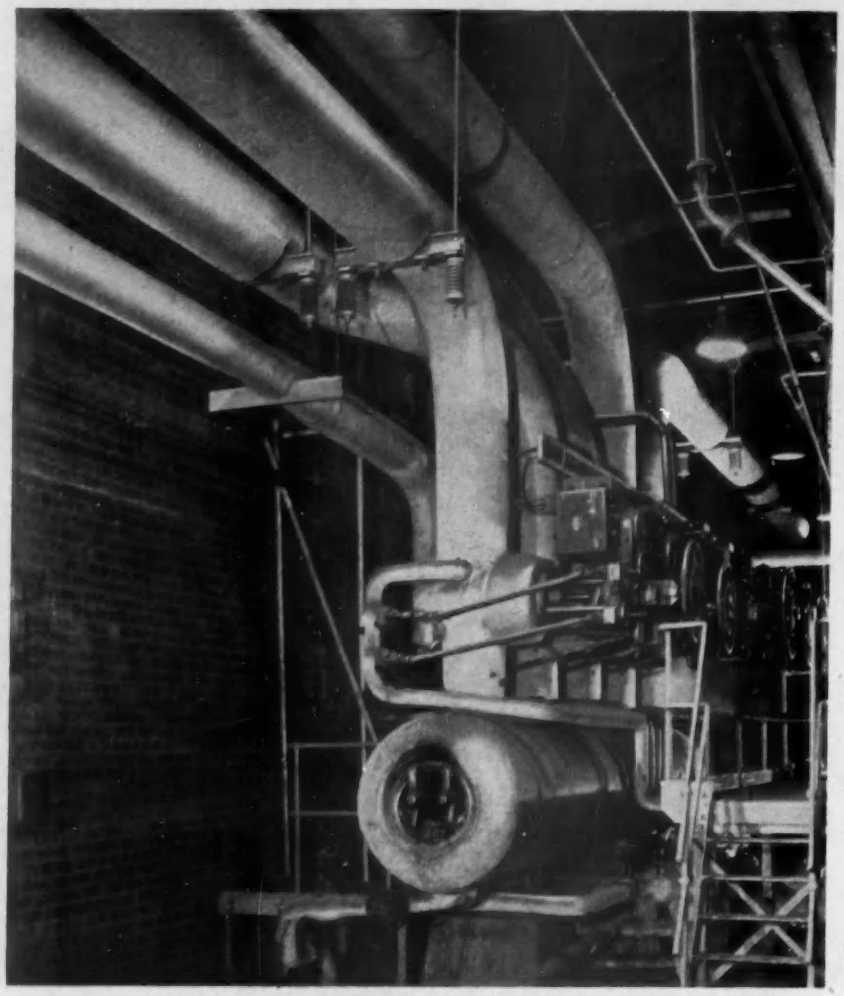


N.108

Its name is NIFE

…LE **STEEL** ALKALINE BATTERY

Nife Batteries · Redditch · Worcestershire



S & L STEAM MAINS

This photograph, taken at the new C.E.A. power station at Carrington, Cheshire, shows an S & L high-pressure steam receiver and its connections. Both the receiver and the steam pipework are in alloy steel, the design conditions being 1030 lb. per square inch at a temperature of 925° F. For both steam and feed pipes all-welded Dawson joints are employed.

Stewarts and Lloyds also provided all the other pipework systems for this power station.

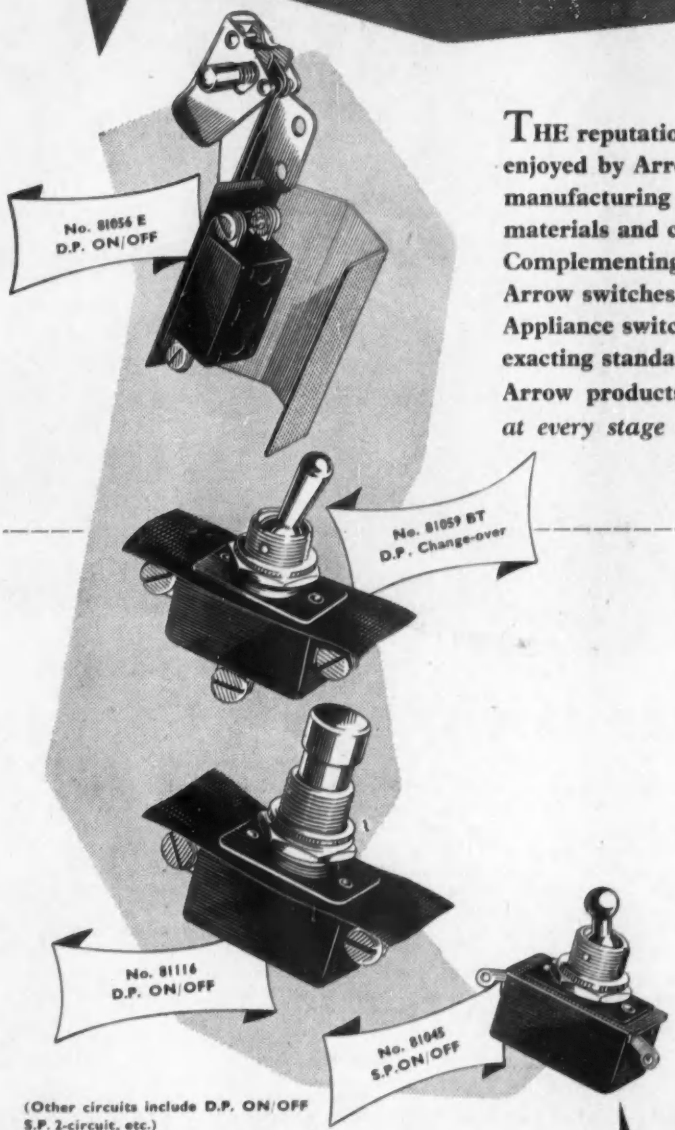
STEWARTS AND LLOYDS LIMITED

GLASGOW · BIRMINGHAM · LONDON

The largest manufacturers of steel tubes in Europe

S&L

AN ENTIRELY NEW RANGE OF "INTERMEDIATE" INSTRUMENT AND APPLIANCE SWITCHES



(Other circuits include D.P. ON/OFF S.P. 2-circuit, etc.)

THE reputation for reliability and efficiency enjoyed by Arrow products stems from a realistic manufacturing policy supported by first-quality materials and craftsmanship.
Complementing the already extensive range of Arrow switches, these new Instrument and Appliance switches are manufactured to the same exacting standards — and like all Arrow products are *individually inspected at every stage of production.*

These switches are all available with solder lugs and binding screw terminals and either type of lever illustrated. They have quick make-and-break mechanisms and carry 3 amp. 250 volt ratings.

Their main characteristic is the maintenance of low contact resistance after considerable life, and are therefore ideal for instrument and electronic work.

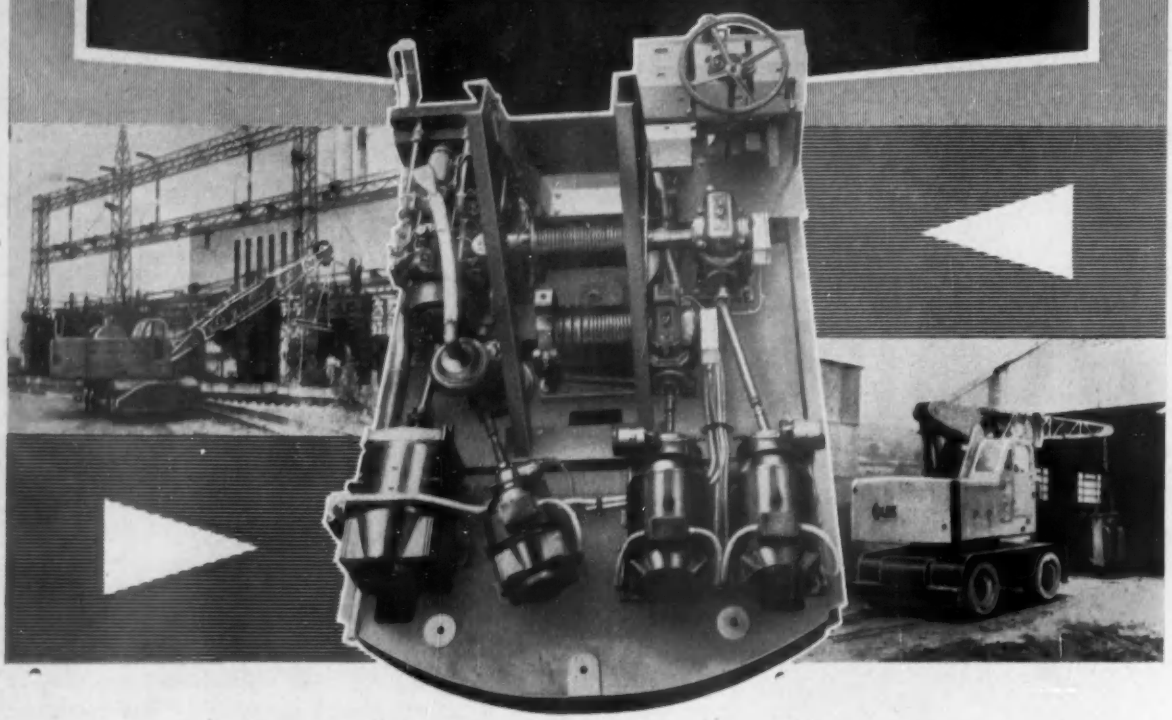
The same switches, when fitted with either spring-loaded trigger levers or double-acting mechanisms, are particularly suitable for portable tools or foot-operated appliances when enclosed switches are preferred and approval in export markets a necessity.

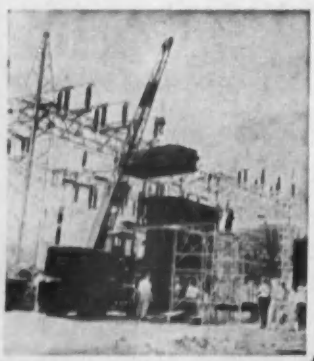
ARROW

SEND TODAY FOR FULL DETAILS

ARROW ELECTRIC SWITCHES LTD · HANGER LANE · LONDON · W.5

✳ The electrical industry chooses Coles electric crane!





✳ and this is why!

This is the machinery deck of a Coles mobile crane. Look at that neat, orderly layout and ask yourself what's different. Then note the simple unit construction — single, self-contained motor and electro mechanical brakes — one for each motion of hoist, derrick and slew. There's one for travel out-of-sight underneath. Each motor is fed from a variable voltage generator driven by a diesel engine. So what do you get? Why, ample and instant power with smooth-as-silk electric operation by those finger-tip controls.

That's why the Coles looks so simple — for it is simple, in design, operation and — naturally — maintenance.

Coles serves the electrical industry in a variety of ways, handling components in workshops and stores and out on the site. Fast, powerful, safe — it's the crane electrical men prefer because it works by simple, reliable, electric power.

Designed, manufactured and marketed by:-

STEELS ENGINEERING PRODUCTS LIMITED.

Crown Works · Sunderland England

COLES

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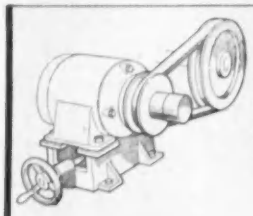
MORE BRANCHES— AT YOUR SERVICE

Luton and Leicester join the industrial centres from which immediate Fenner service is available Now there are 18 Fenner branches which can give you first class power transmission service. Experienced men at all these centres are ready to design drives which will cut your costs.

From stock at each of these branches you can get the full range of Fenner products—V-Belts, Taper-Lock Bushes, V-Pulleys and Flexible Couplings, Taper-Lock Chain Sprockets (and Roller Chain), Torque-Arm Shaft Mounted Speed Reducers, Hainsworth Variable Speed Drives and all types of Flat Beltings.

Use your nearest Fenner Branch—it's there to help you.



HAINSWORTH VARIABLE SPEED DRIVES for use with motors up to 35 H.P. . . . Special types available for spinning frame drives . . . Simple and positive speed selection.

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The popularity of the well-tried and proved 47AB continues to grow, but increased production is keeping pace with sales and undue delay in delivery is a thing of the past—and this applies to *all* Belling electric cookers. We can't deliver "off the shelf" but now that all our new plant is at work we can make up any cooker to your specification and deliver it by road within two or three weeks of the receipt of your order, but in special cases we can do even better than that.

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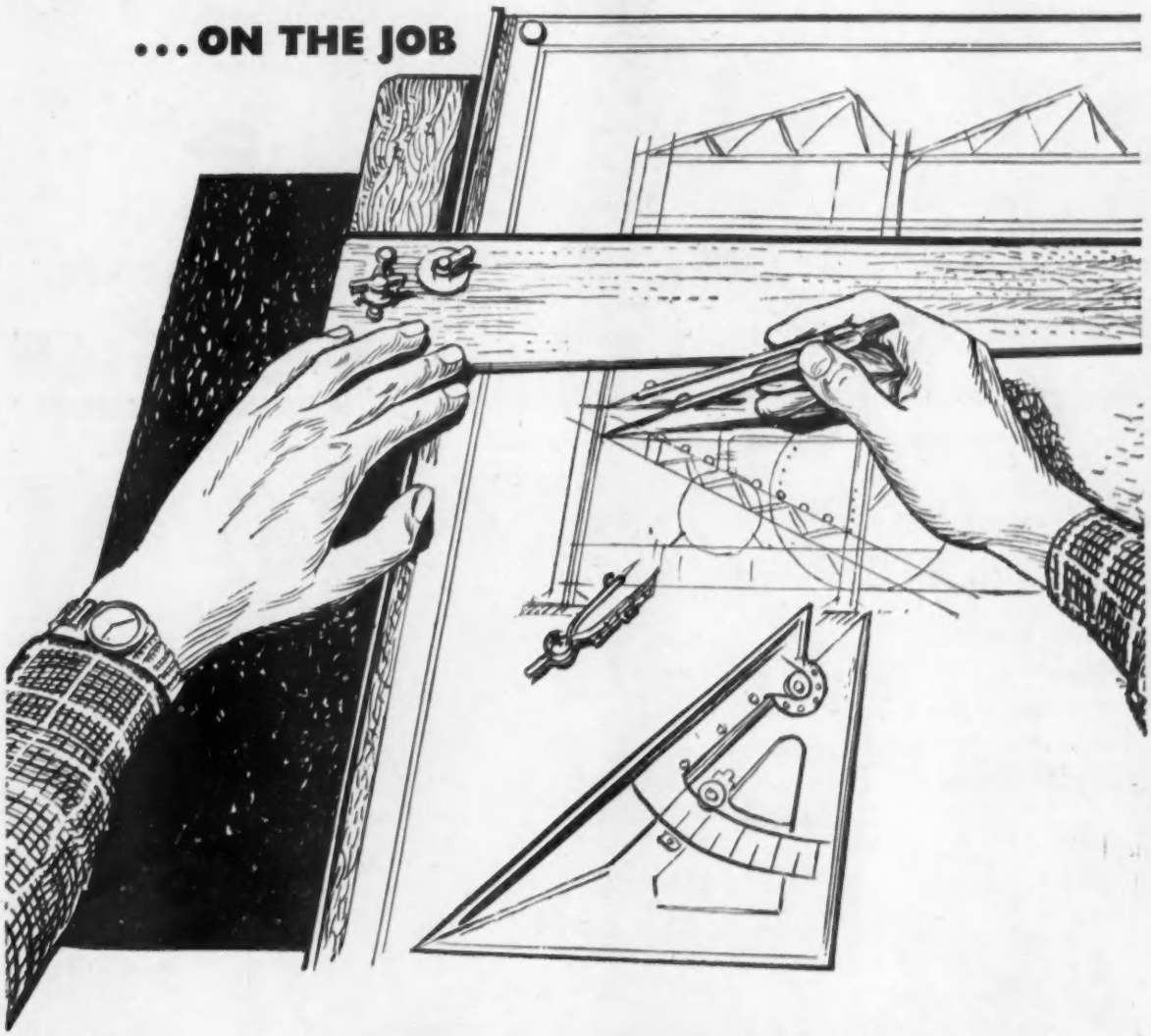
...ON THE JOB



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METROPOLITAN-VICKERS ELECTRICAL COMPANY LTD., St. Paul's Corner, St. Paul's Churchyard, London, E.C.4.

Member of the A.E.I. Group of Companies.

ML3

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ROTARY SPECIALISTS

MF. SERIES
Rotary
4-5 amps. 220/440 V. AC.
Up to 12 positions.

Other Rotary Types
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15/30 amps. 220/440 V. AC.
Up to 8 positions.

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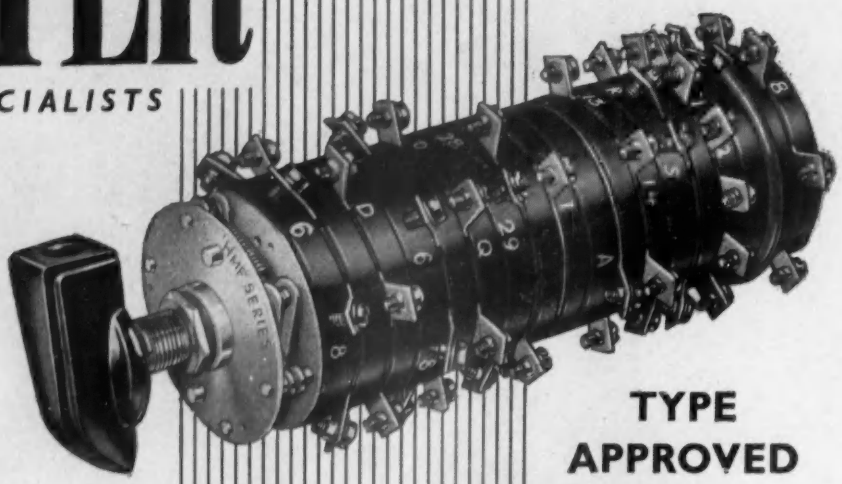
10 amps. 250 V. AC./DC.
Up to 8 positions.
Hermetically Sealed. Key Operated.

SINGLE AND MULTI-WAY
PUSH BUTTON SWITCHES
APPLIANCE SWITCHES



TYPE
APPROVED
SWITCHES

CRATER PRODUCTS LTD • LYE WORKS • WOKING • SURREY

R6

MULSIFYRE PROTECTION

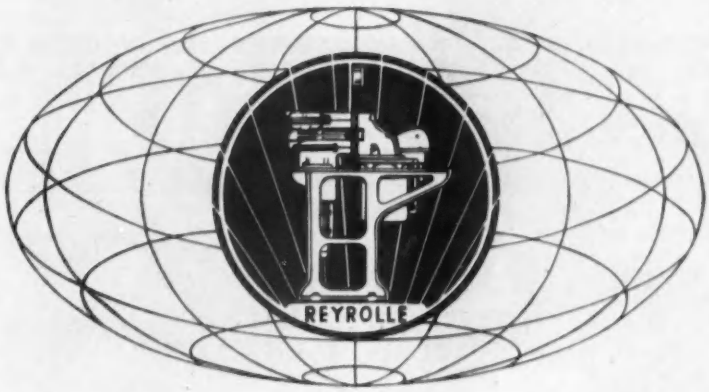
Generator transformers at the Huncoat Power Station, C.E.A., Accrington, protected against fire by the Mulsifyre System. Write for descriptive literature.

556

Photo by courtesy of G.E.C.

Mather & Platt
LIMITED

PARK WORKS, MANCHESTER 10



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Manufacturers of:

AIR-BLAST SWITCHGEAR

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HIGGS MOTORS LTD.

MANAGING DIRECTOR DAVID C.Y. HIGGS, A.M.I.E.E.

BIRMINGHAM 6 ENGLAND

Single Phase Motors ¼ HP to 3 HP
Popular Sizes Ex Stock

GUARANTEED FOR EVER

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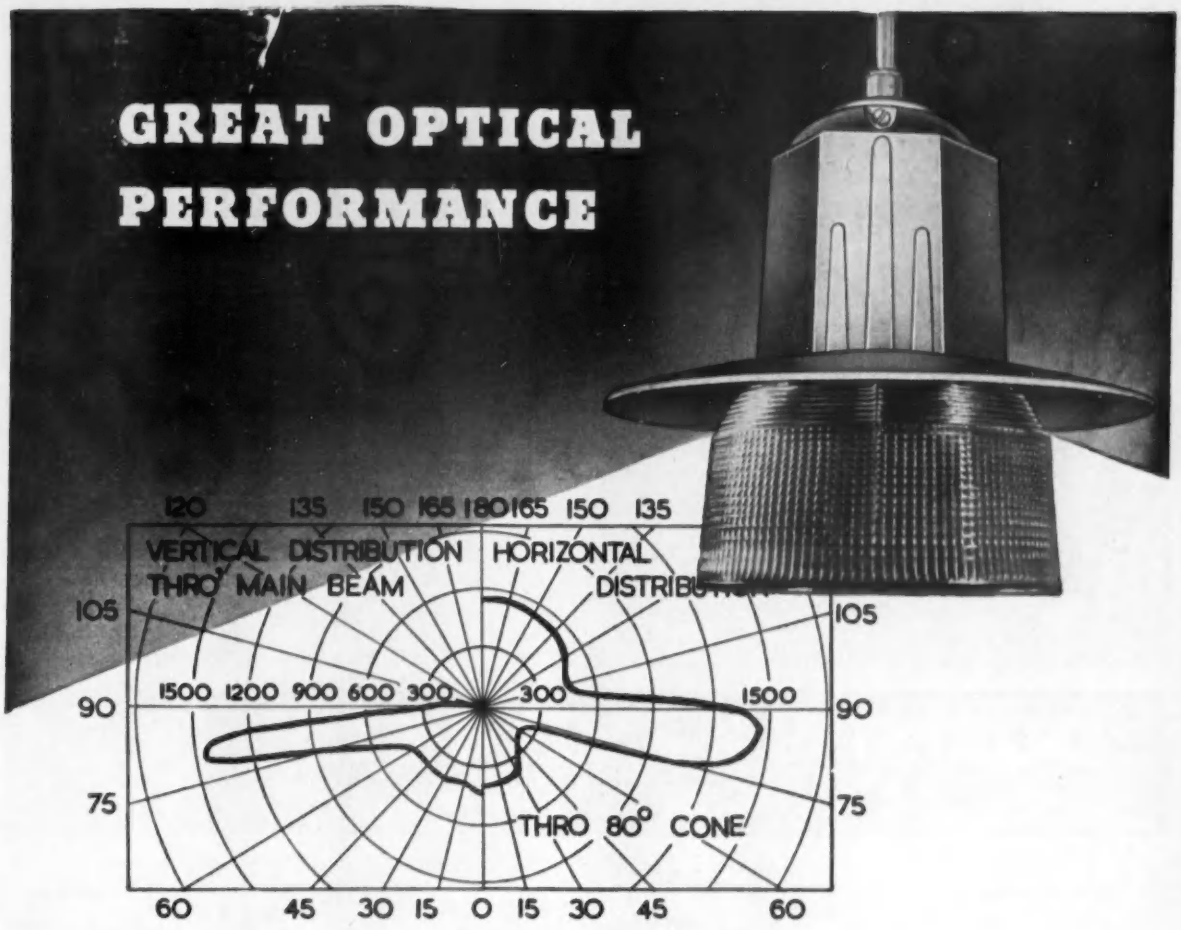
GREAT OPTICAL PERFORMANCE



PLUS THESE OUTSTANDING FEATURES!

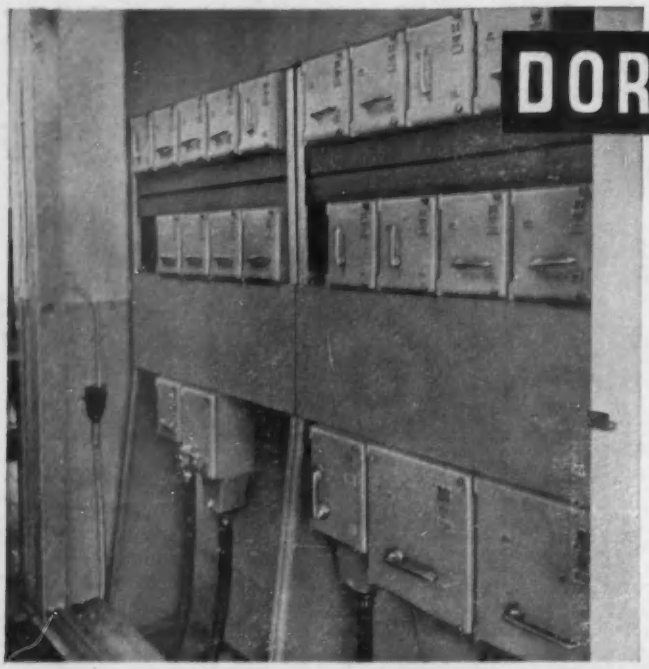
The 'Welwyn' one of the series of street lighting lanterns designed by Eleco is made for 100-200 watt Tungsten, or 80-125 watt Mercury Discharge Lamps. The 'Welwyn' besides giving the highest degree of optical performance—will give years of trouble-free service with a minimum of maintenance.

Here are some of the reasons why:

1. The lantern is made in only 3 main parts: die-cast aluminium body; the lamp holder bridge assembly; dome type refractor.
2. The refractor and focal position stops are cast with the body.
3. The lamp holder bridge and lamp holder can be removed by loosening focal stop screws and turning slightly.
4. Single piece glass dome refractor (available for axial or non-axial distribution) gives maximum light control and high output.
5. The refractor is firmly held in correct relation to the body, by solid internal spring loaded clips.
6. These springs are enclosed within the body casting—completely protected from the weather.

ELECO **ENGINEERING & LIGHTING EQUIPMENT CO. LTD**

SPHERE WORKS · ST. ALBANS · HERTS



DORMAN

SWITCHBOARD

SELECTED FOR

UNITED STATES AIR FORCE

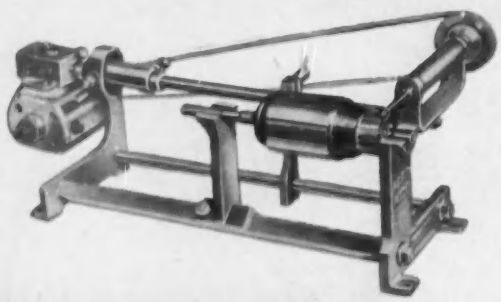
Another outstanding example of speedy Switchboard construction using DORMAN standardised units is to be seen in the Switchboard of 60, 100 and 300 amps. capacity assembled on site in just 24 working hours for the United States Air Force Base at Prestwick. The DORMAN system saves time, space, labour and expense. Photograph by courtesy of H.Q. 1631st U.S.A.F. Air Base Group, Prestwick.

Contractors: Messrs. James Plucknett Ltd.

DORMAN & SMITH LTD.

THE WORLD'S BEST L.T. SWITCHGEAR

MANCHESTER, 5 and also at LONDON, GLASGOW, BELFAST



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AERO-AUTO UNDERCUTTER

An inexpensive and reliable machine for the rapid undercutting of micas of small armatures as used in automobile dynamos and starters, and in aircraft electric motors.

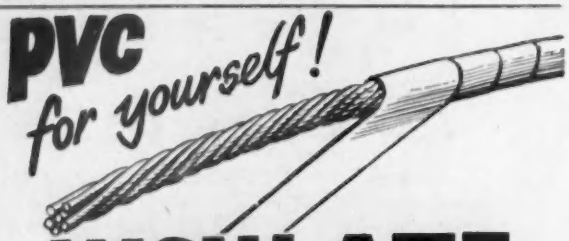
Write for descriptive leaflet to:

MARTINDALE ELECTRIC CO. LTD.

45 WESTMORLAND ROAD, LONDON, N.W.9

also at 25 ELMBANK STREET, GLASGOW, C.2

PVC for yourself!



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The new P.V.C. Self-adhesive insulating tape available in 6 colours in widths of ½" upwards.

- ★ ONE layer equals many of old-fashioned black cotton tape.
- ★ GREAT dielectric strength (10,000 volts) yet wafer thin.
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HEDDOTAPE is a product of the Heddon-Smith Group of Companies

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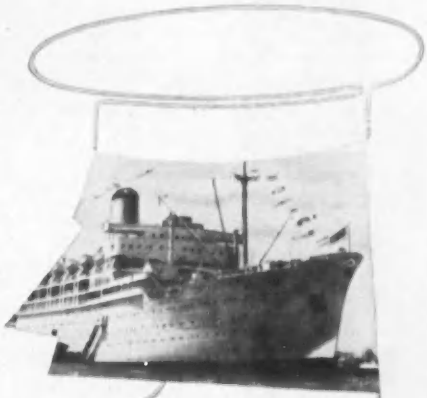
DHB/2172

on land...



on sea...

In fact everywhere,

even deep beneath the earth,

PIRELLI-GENERAL cables are carrying

light and power to keep the wheels of industry

and commerce turning—24 hours round the clock

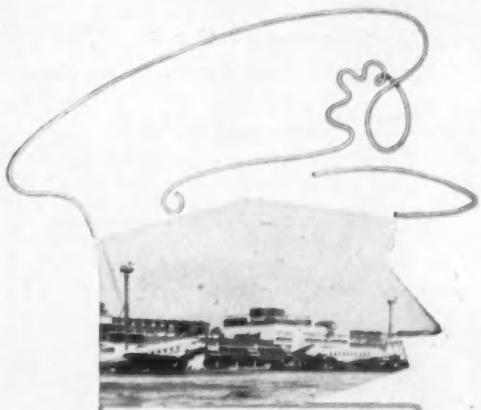
around the world.

From the slender strand of wire to the giant high

tension cable, the safety and welfare of

millions depend on cable confidence—

PIRELLI-GENERAL CONFIDENCE.



or in the air...

PIRELLI-GENERAL
CABLES
in the nation's service

Order from the G.E.C.

THE GENERAL ELECTRIC CO. LTD · MAGNET HOUSE · KINGSWAY · LONDON · W.C.2

Original KLÖCKNER-MOELLER·BONN

ELECTRIC CONTROLGEAR
CONTROL CABINETS
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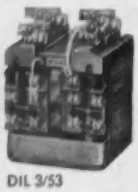
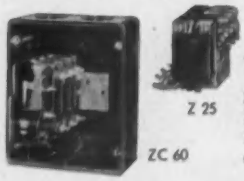

DIL 3/53

A.C. Contactors
splash and dust proof enclosure
3-pole up to 600 V
with or without thermal overload relay
for high frequency of operation
and long service life
or for normal frequency of operation
and continuous duty


Z 25
ZC 60

Thermal Overload Relays
3-pole, from 0.35 – 240 amps.,
Z 6, Z 15, Z 25 amps. up to 300 V,
Z 60, Z 100, Z 200 up to 600 V,
open or dust- and splashproof form resp.

DIUZL 5/54

Group mounted contactors
Reversing contactors, multispeed
control, automatic bustransfer,
automatic A.C. motor starters for
squirrelcage induction and slipring
motors, power factor controls.

P 200a - 3i/41

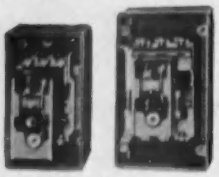
Knife Switches
3-pole, up to 600 V service voltage,
up to 1000 amps. service current;
possibility of switch fuse combination.

SDAINZL 3/53

Automatic
Star-Delta Starters
3-pole up to 600 V,
with or without thermal overload relay
Dust- and splashproof enclosure

P 3a-2.2i/50.Kg
PS 3-3i/48 Fa

Small Drum Switches
for flush and surface mounting
max. service voltage 500 V,
as disconnecting switches with or without
fuses, group switches, series parallel
switches, three way switches.


PKZ 2 + PKZ 3

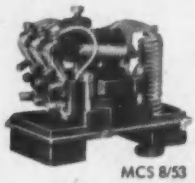
Push Button
Motor Protection
Starters
3-pole up to 25 amps.

PMU 4a-5i/50

Drum Switches
for flush and surface mounting as
change-over, star-delta, isolating,
and pole changing switches;
max. service voltage up to 600 V.

FAK 1

Foot Switches
single pole up to 600 V,
dust- and splashproof enclosure,
max. making current 60 amps.,
max. breaking current 6 amps.,
continuous duty 6 amps.


MCS 8/53

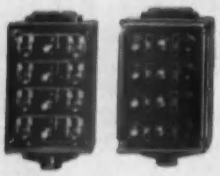
Pressure Controls
with rubber membrane or bellows,
single or three-pole for D.C. or single
phase A.C. up to 220 V and three phase
A.C. up to 500 V for service pressures
of from 15.6 up to 234 lbs/sq.in.

AT 1-i/53

Limit Switches
Open type or dust- and splashproof forms;
max. making current 60 amps.
max. breaking current 6 amps.,
continuous duty 6 amps. with one N/O
and one N/C, or 2 N/O and N/C
contacts respectively.

SWN 6

Float Switches
single pole for D.C. and single phase
A.C. up to 220 V; three pole for
three phase A.C. up to 500 V.


DSKL 42

Push Button Stations
with built-in signal lamps and selector
switches, as required,
max. making current 10 amps.,
max. breaking current 6 amps.,
continuous duty 6 amps.

DBM 40

Solenoids
single and three pole up to 600 V
in dustproof enclosure

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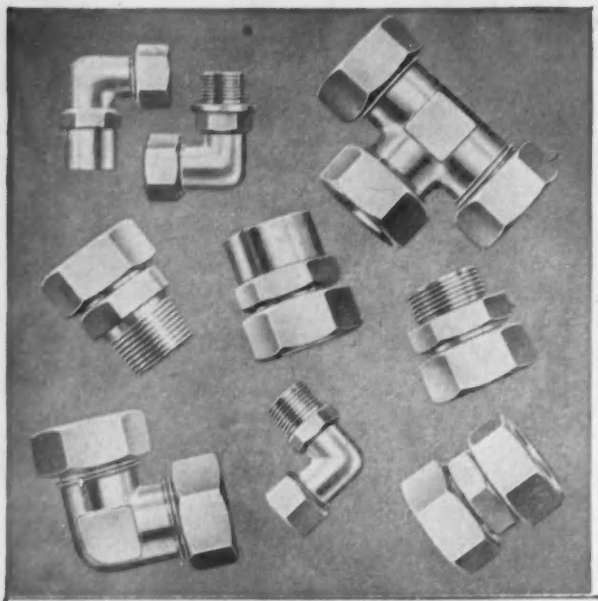

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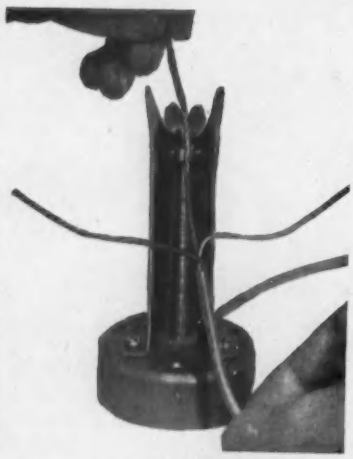

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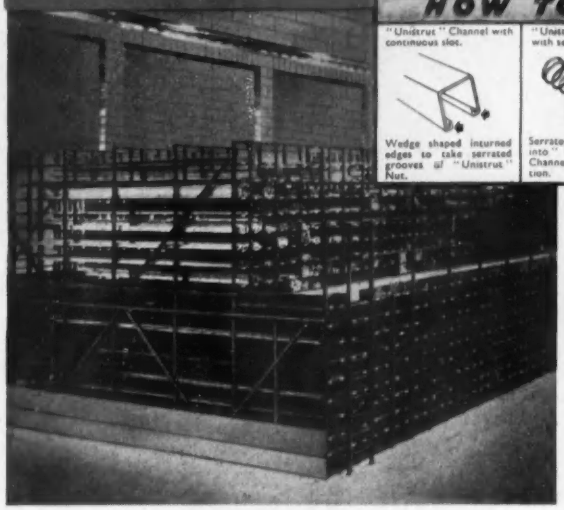

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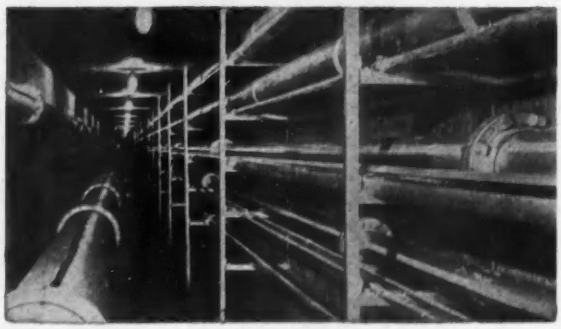

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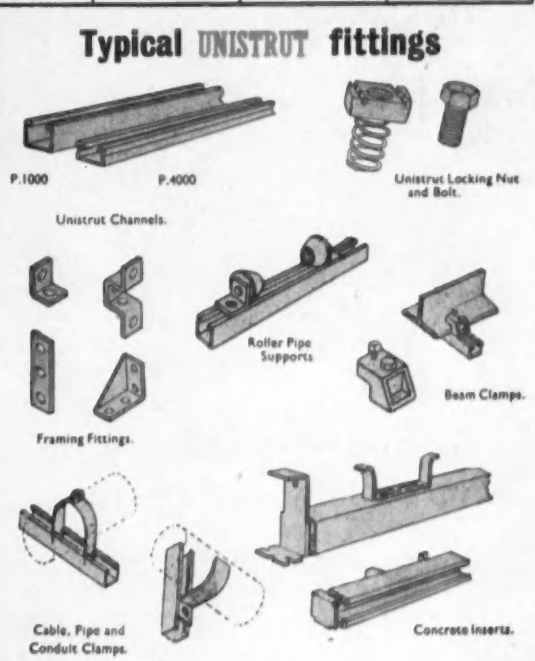

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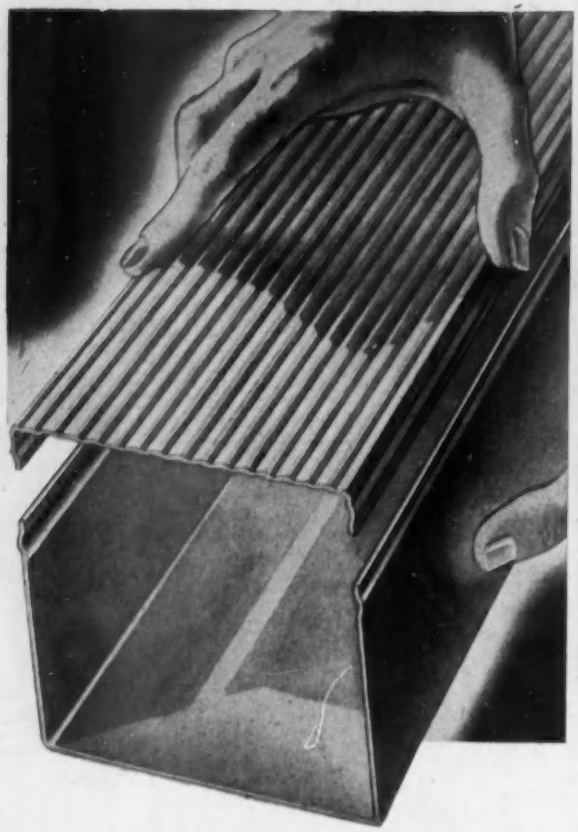

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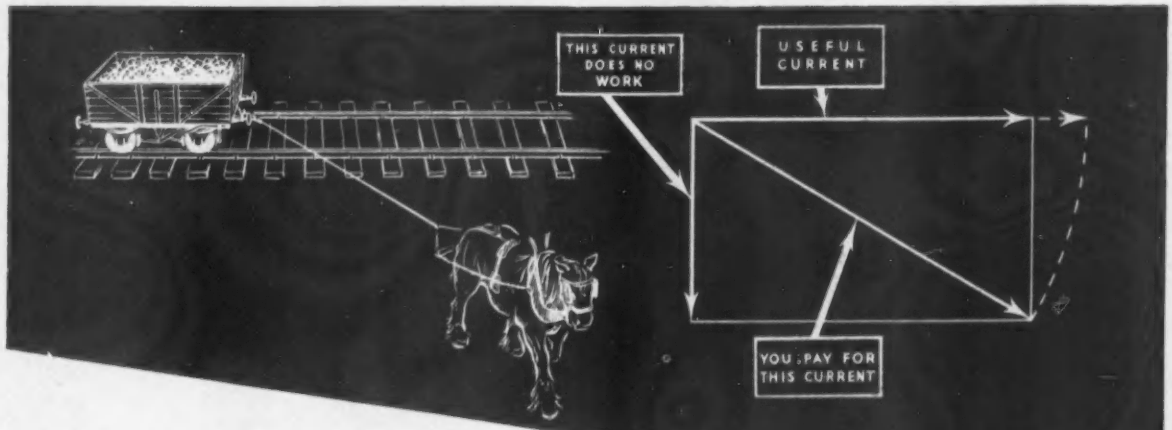

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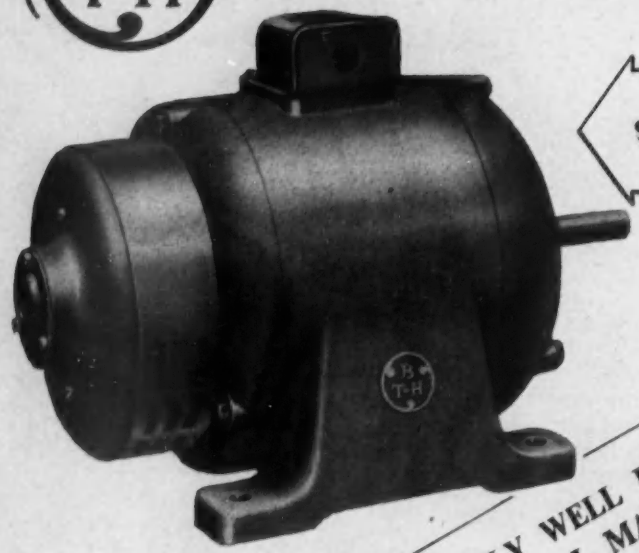

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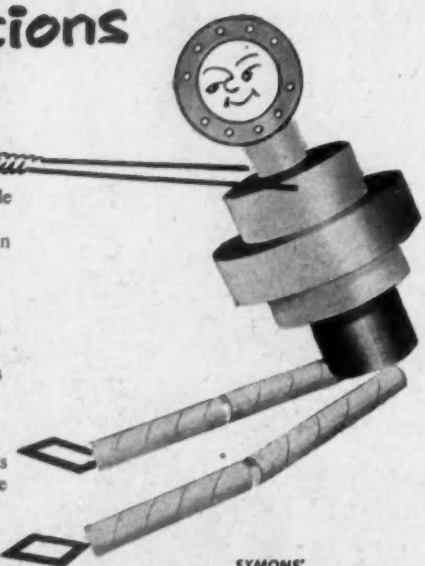

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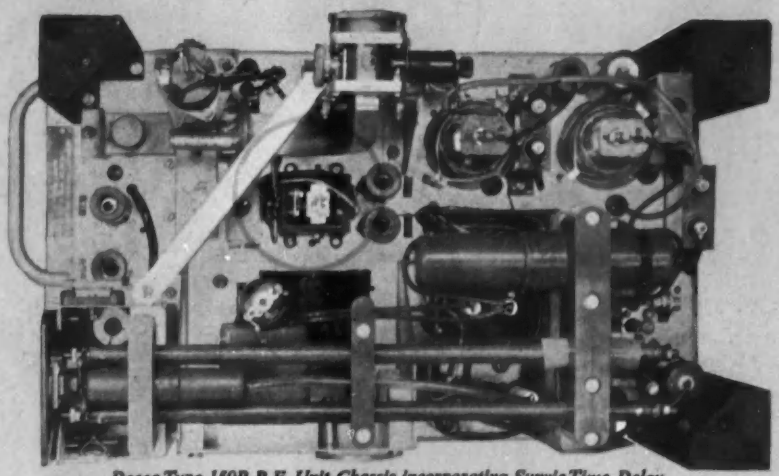

Decca Type 159B R.F. Unit Chassis incorporating Sunvic Time Delay

(Photograph by courtesy of Decca Radar Ltd.)

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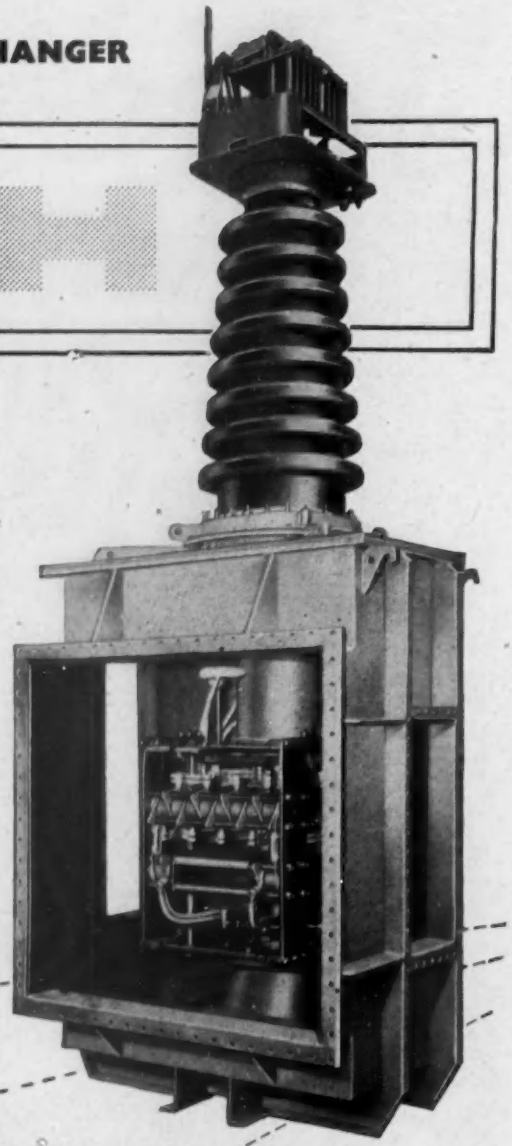
TYPE H



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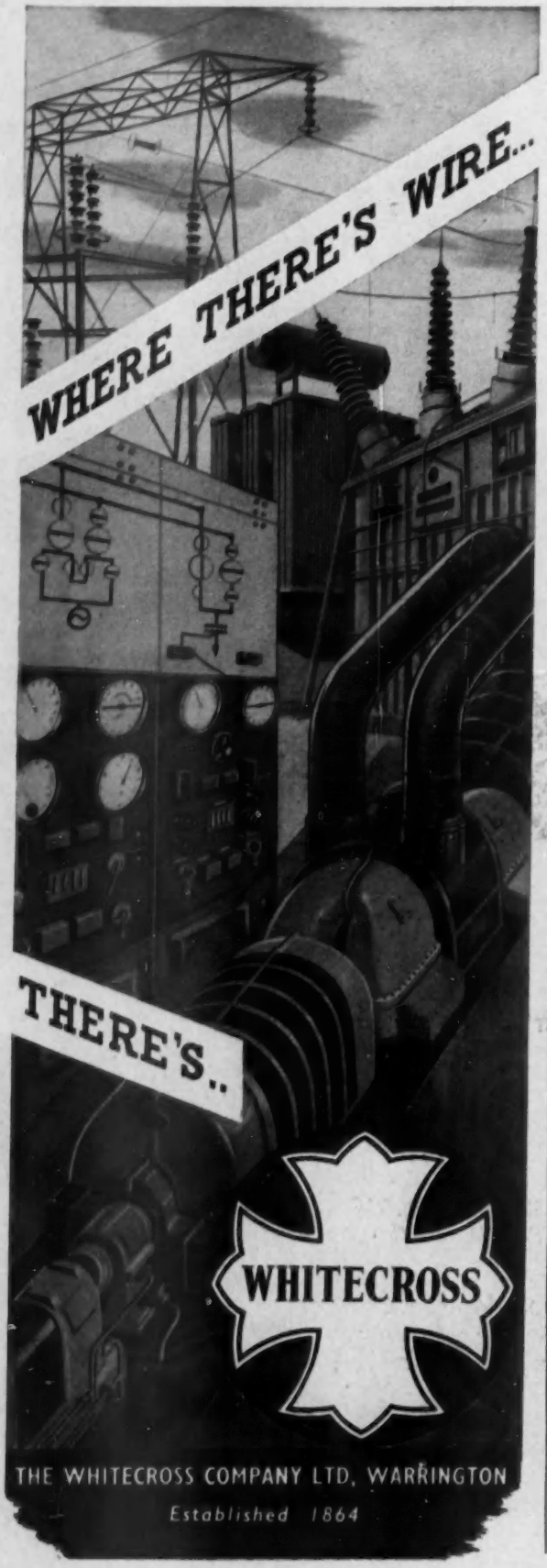

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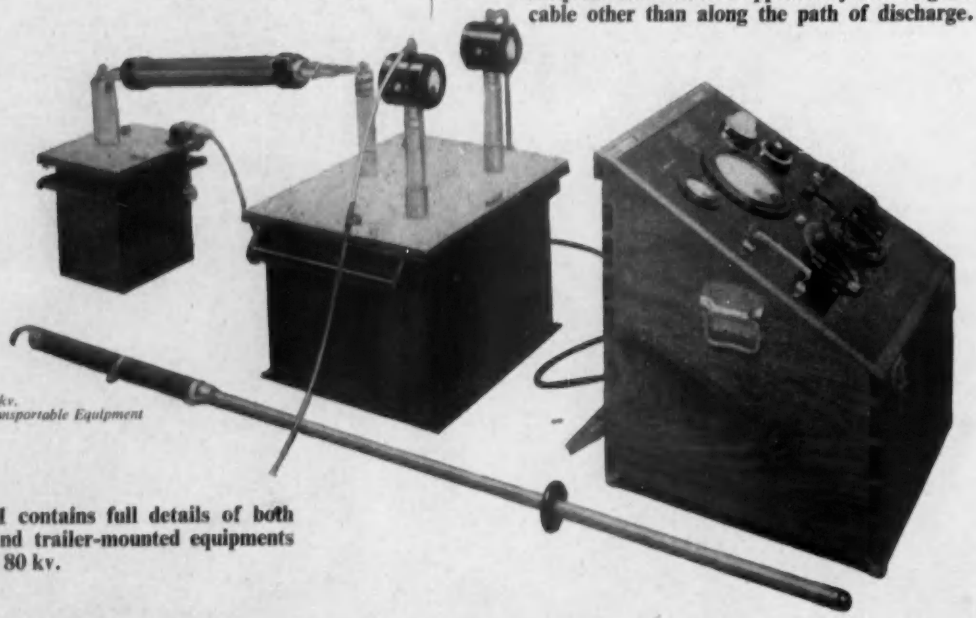

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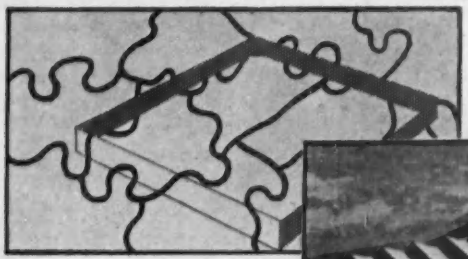

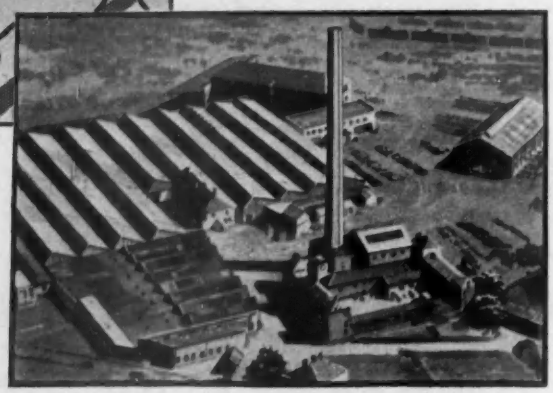

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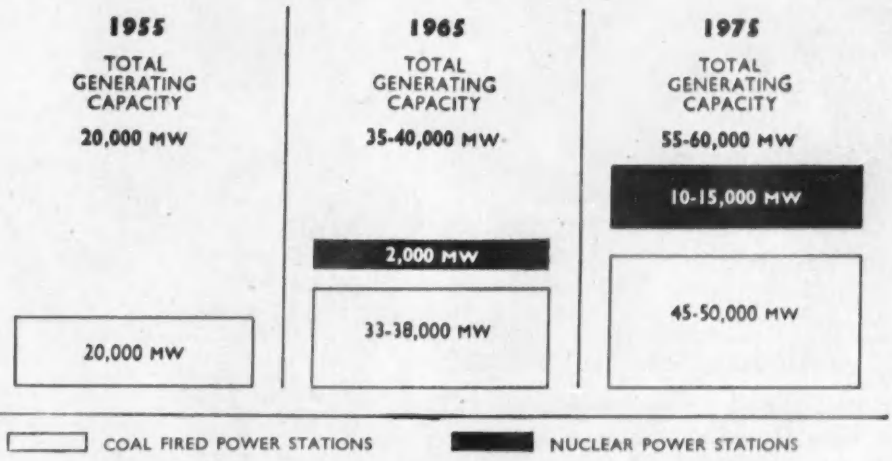

20 years' development programme

Britain's nuclear power station construction programme provides for twelve such stations to be built at a cost of some £300 million in the next ten years.

The First Ten Years

Work will start on the first two nuclear power stations in 1957. These will each have two gas-cooled reactors and the stations will be in operation by 1960/61. Two further gas-cooled reactor stations — each housing two reactors of improved type — to be begun in 1958/9 will come into service by 1963. The output of these four stations will be between 400,000 and 800,000 kilowatts.

The construction of two groups of four stations each will begin in 1960 and 1961/2 and they will be supplying electricity to the Grid by 1963/4 and 1965 respectively. The first group of stations will probably have one gas-cooled reactor each. The second group will probably utilise liquid-cooled reactors — one high rated reactor each. These stations will add well over 1,000,000 kilowatts to the nation's power resources.

The Second Ten Years

By 1975, it is anticipated that nuclear reactor power stations in Britain will have an aggregate installed capacity of between 10,000,000 and 15,000,000 kilowatts; and about half the national consumption of electricity will be derived from nuclear energy.

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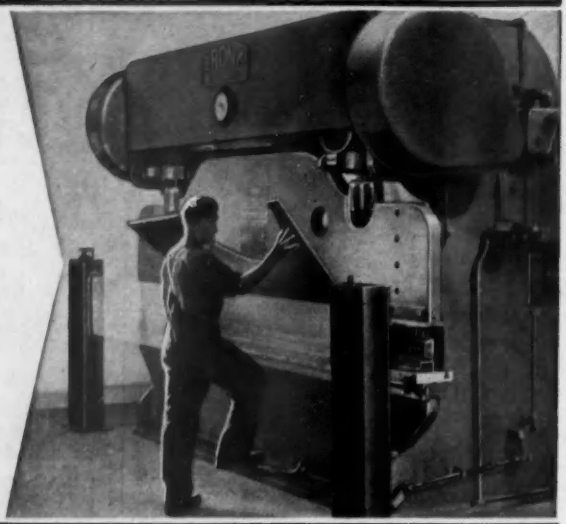

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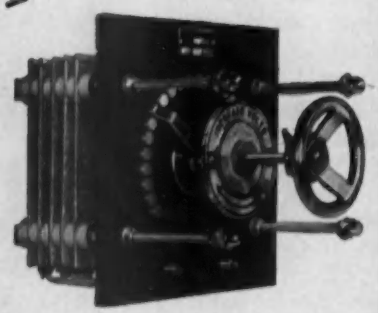

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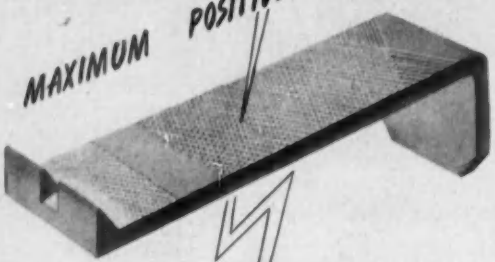

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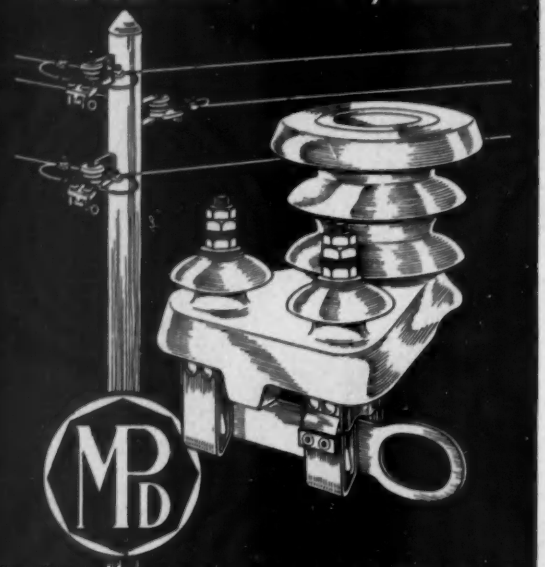

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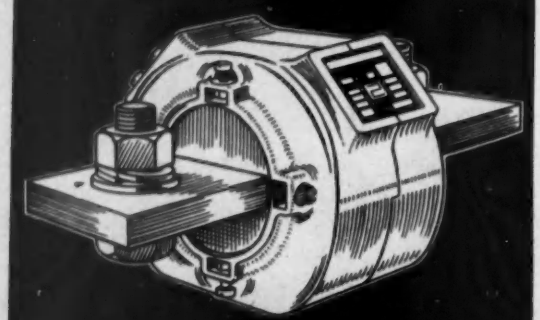

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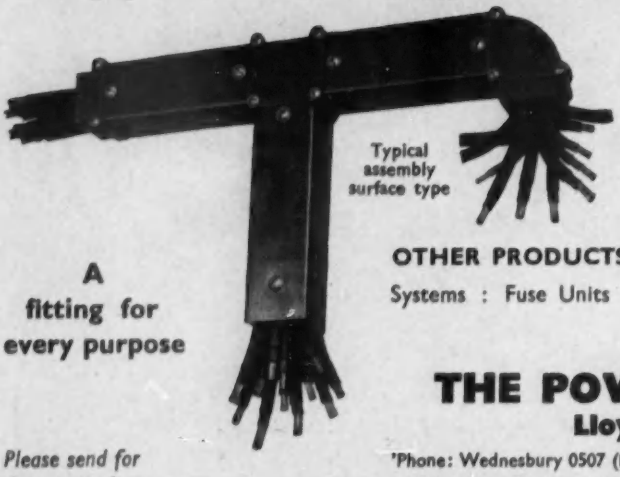

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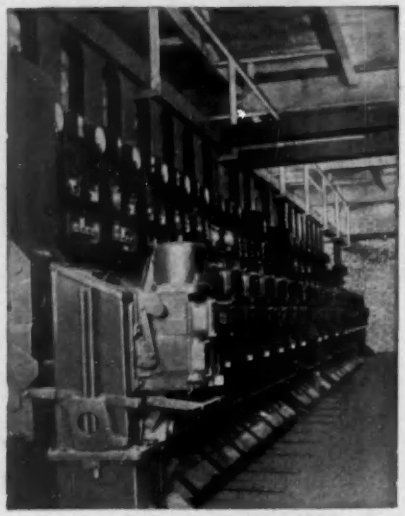
A typical purpose made Cable Trunking installation carrying control cables



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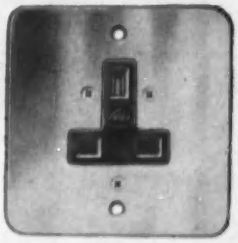

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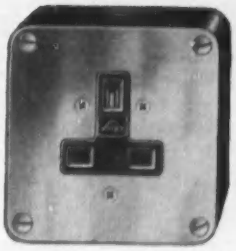

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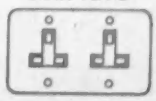

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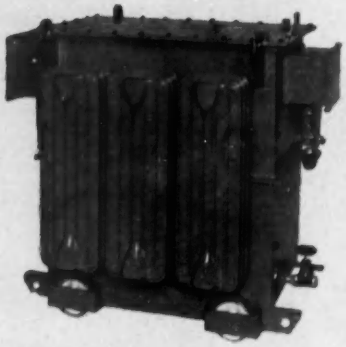

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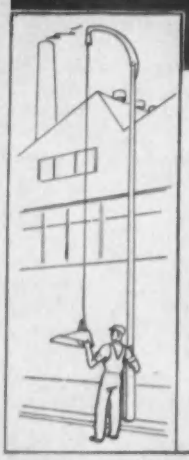

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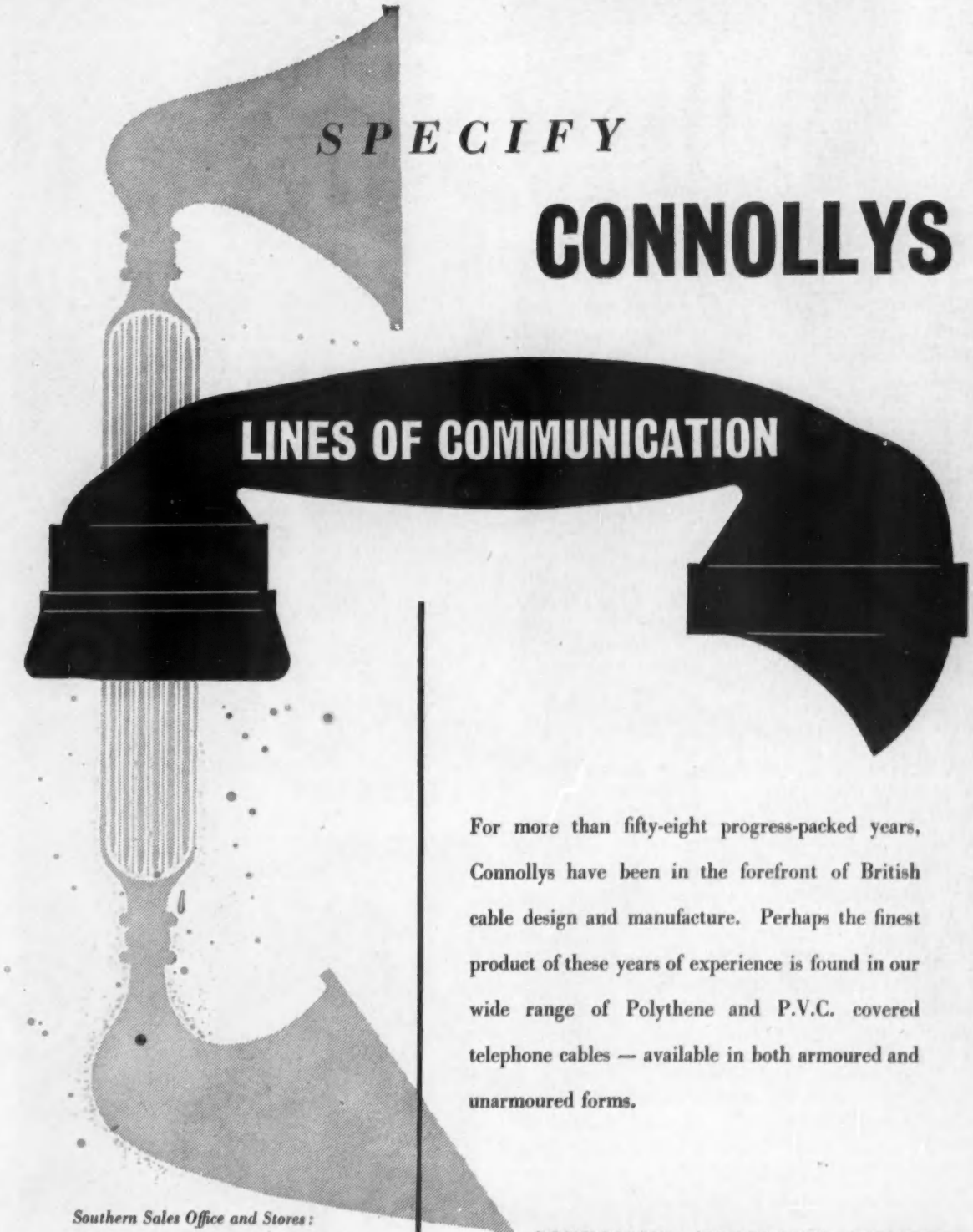

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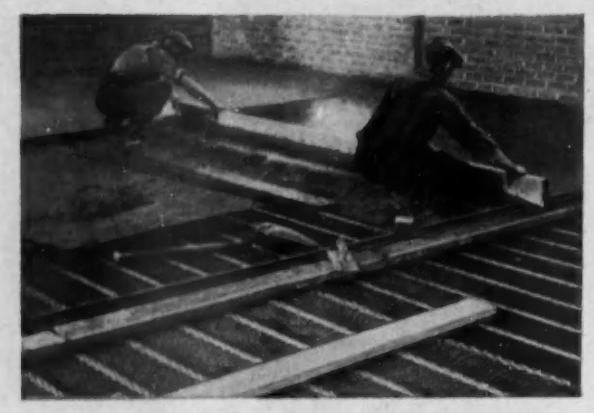

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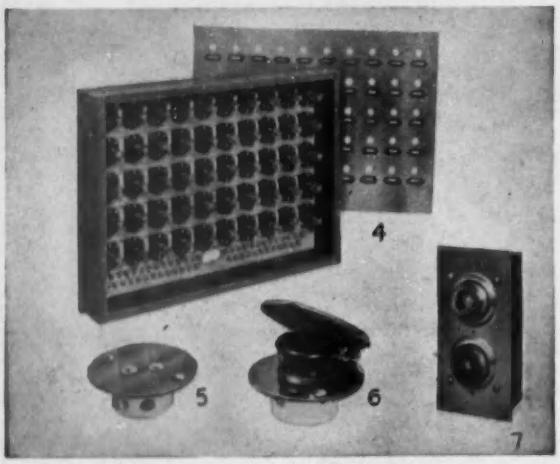

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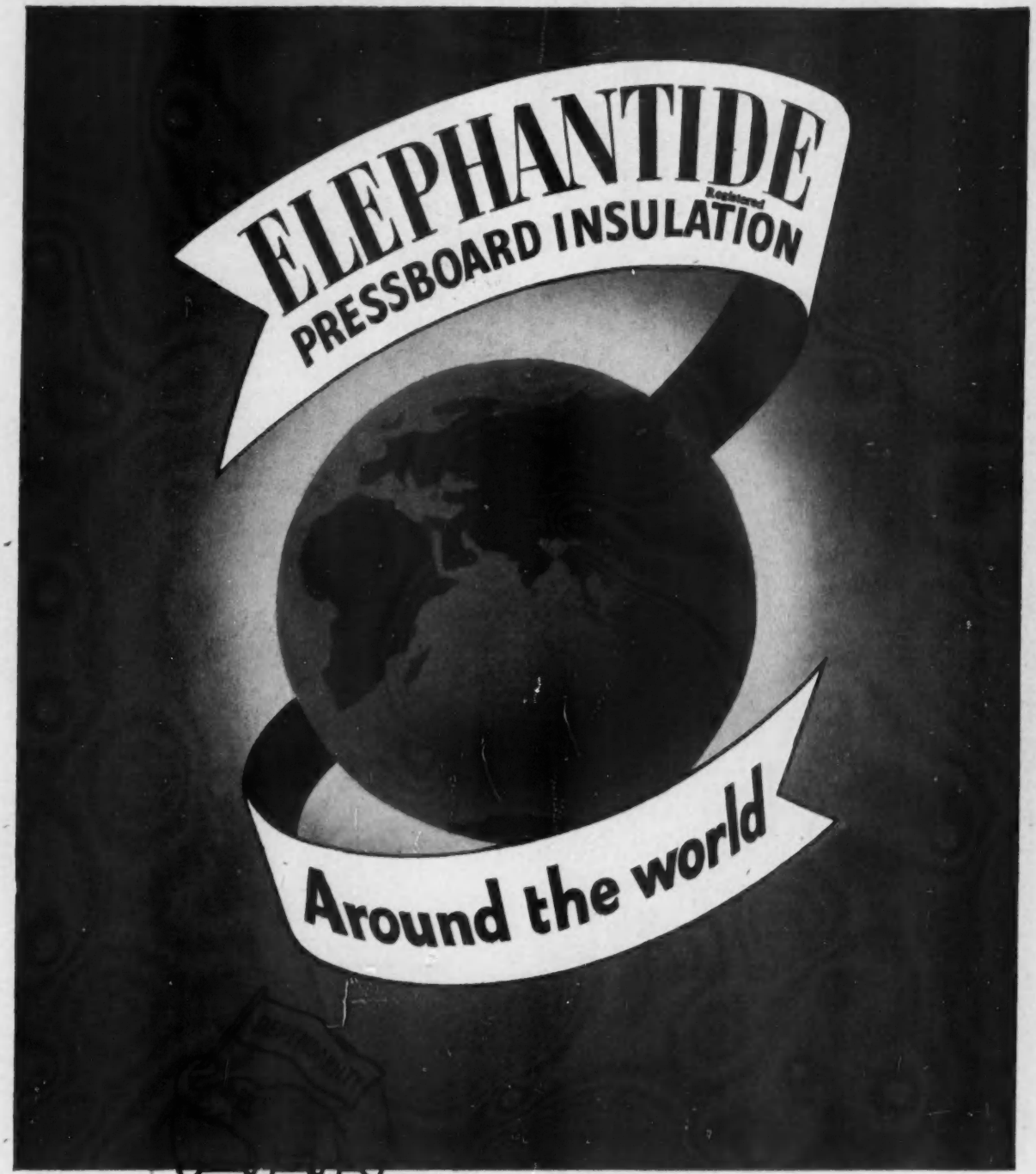

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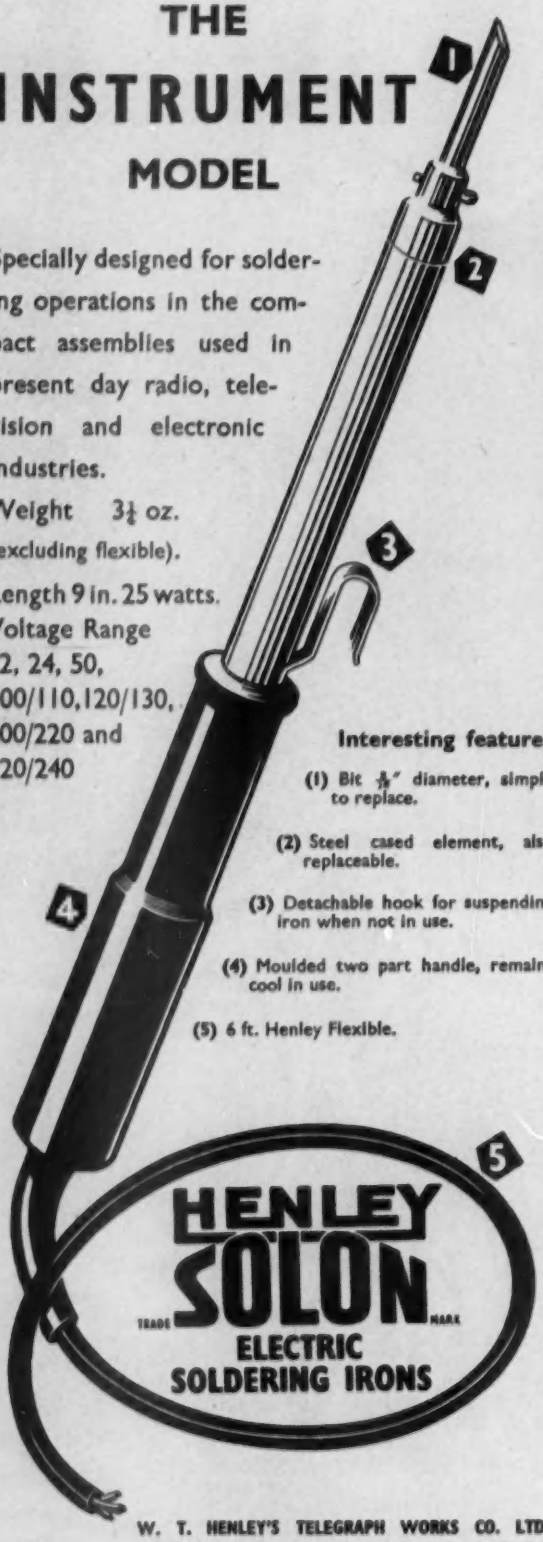

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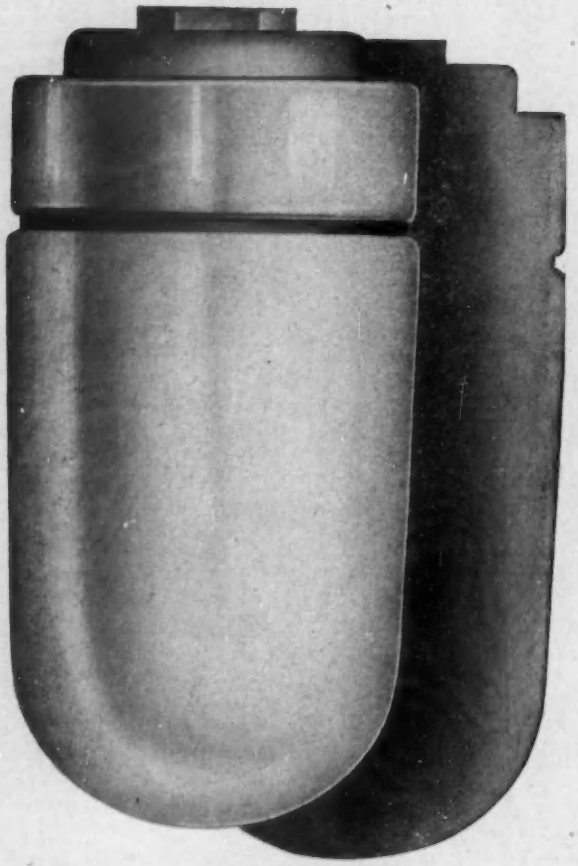

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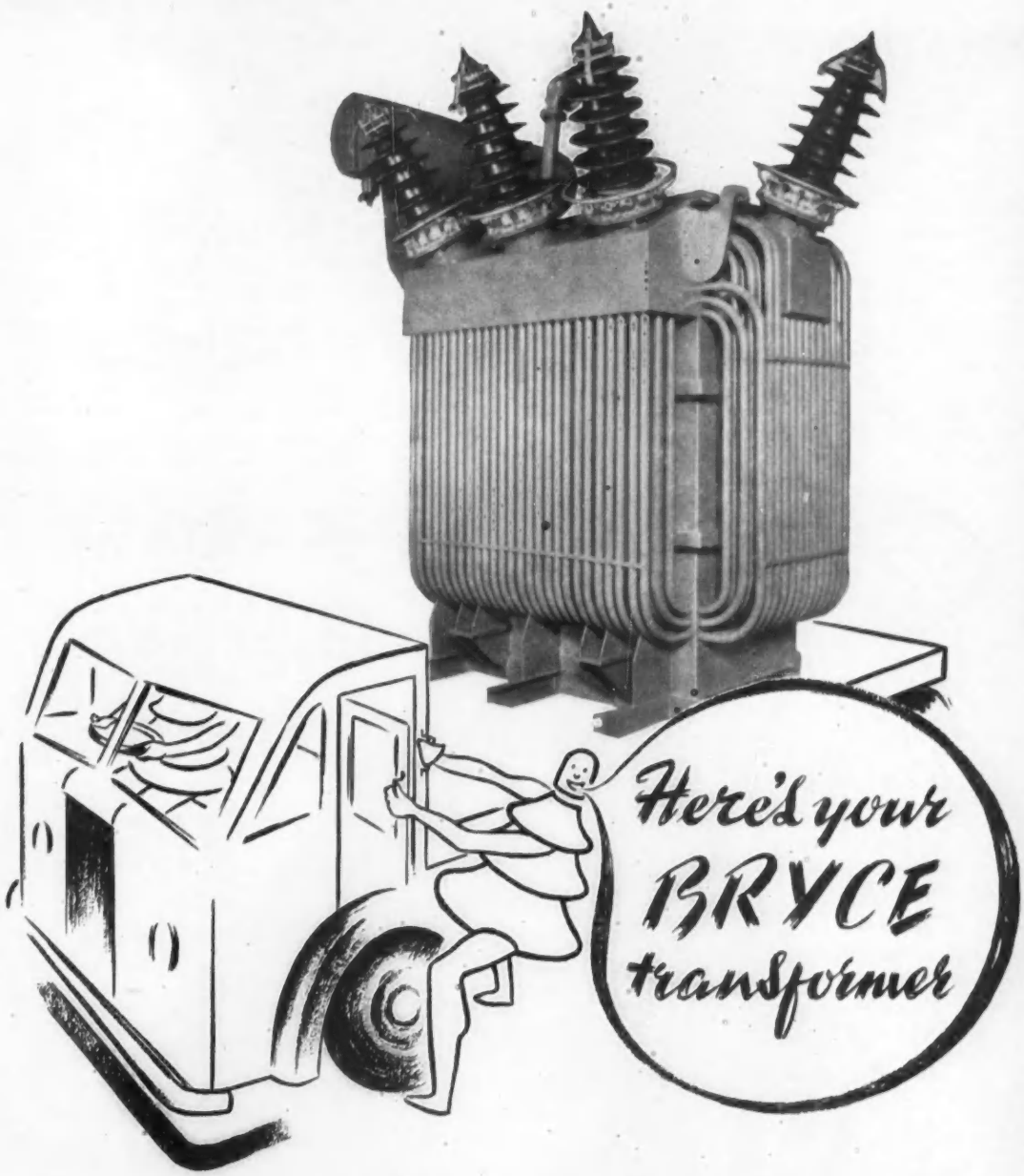

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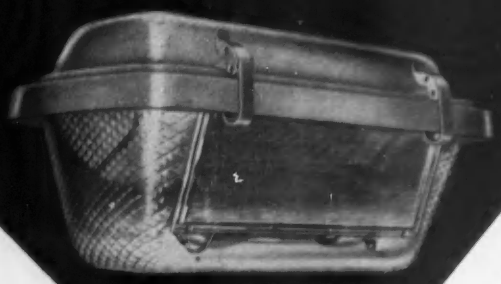

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ELECTRICAL TIMES

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LOOKING AHEAD

The old year will close on a period of unprecedented business activity and the very brightness of the situation conceals the high financial blood pressure from which the country's economy is suffering. Uncertainty for the future lies in the doubt whether Dr Butler's medicine will be fully effective, particularly with a new epidemic of wage claims to face. This situation must necessarily have an impact on the supply industry and with the edict that reliance must be placed on more internal financing for the £200m a year demand for capital, some increase in electricity tariffs is to be expected early in the New Year, as the industry's offering up of the consumer, on the altar of the credit squeeze. The year should get away to a lively start with the publication of the Herbert Committee report on the C.E.A., which is promised for some time in January. What it has to say will set the tone for developments in the supply sector of the industry, and may bring electricity supply startlingly in the public eye once more. The major prospect for the year, however, is the chance that Britain may begin the generation of nuclear power, with the commissioning of Calder Hall. Spectacular as this may be, the real progress will be in the C.E.A.'s move into the field of design of the first nuclear stations to be owned by the supply industry itself. The manufacturing side of the industry must be content to bask in reflected glory, although they carry the greater burden of technical development. No headlines for them; only the continuing drive for exports and the slow attrition of the monopolies enquiry, the end of which is not yet in sight. But in spite of troublesome reports, credit difficulties, embargoes on trading and shortages of fuel, there can be no doubt that the electrical industry will move on to new records. The strength of the industry lies in the conviction that electricity is the servant of the future, and in the men who hold that belief.

CHANGES AT THE TOP

There is at least one way in which electricity supply will begin 1956 with a new look. The long-established team of Geoffrey Lloyd and L. W. Joynson-Hicks has been disbanded in the ministerial reconstruction, with singularly little grace, and in their place at the Ministry of Fuel and Power will reign Mr Aubrey Jones and Mr D. Renton. In welcoming a new political head to the Ministry which exercises ultimate control of the supply industry, it is reassuring to note that the incoming Minister has, through his British Iron and Steel Federation activities, recent experience of large scale modern industry

and its needs. But it would be ungrateful to let Mr Lloyd depart unsung. He has filled his long period of office at this important if unglamorous ministry with competence, and without the major blunders which are so easy in any position of authority haunted by the uncertainties of British coal production. Amongst many memorable events, he can look back on the launching of the ambitious nuclear power programme and the calling in of oil to bridge the gap in fuel supplies left by the shortcomings of coal. Moreover, and this is how electrical people will recall his years of power, Mr Lloyd was always ready to speak up for the electrical industry when it was under attack. In this he differed from some of his predecessors, and he had an important part in rebuilding the morale of the industry when the period of continued excuses for shortcomings and failures had passed, and reasonably equal competition could be offered to more fashionable fuels. We trust that Mr Jones and his colleague will recognise that this at least is a practice worth perpetuating in their new charge, in which we wish them every success during the testing times ahead.

CONTINUITY OF SUPPLY

Continuity of electricity supply to the consumer is a primary requirement; to the electrical engineer it involves a problem of assessing the relative economic values of possible damage to plant and the goodwill of the consumer. This task is being made no easier by the amount of time-expired equipment which is necessarily being kept in service because of replacement difficulties. Within the past few weeks several supply failures have occurred, affecting widely separated sections of the working population; transport and commercial undertakings, shops, mines and industrial firms located in the areas concerned have all been seriously inconvenienced. In the absence of full information concerning circumstances surrounding these breakdowns, it is difficult to assess the relative responsibility of equipment. It is, nevertheless, generally known that on many distribution systems increasing demand is still outstripping the capacity of existing cables, transformers and switchgear. Any unusual combination of circumstances such as a cold Monday coinciding with dark skies places a severe strain on networks and proves a testing time for any weak link in the chain of distribution. The elimination of such links becomes the more important as electricity is increasingly used for essential tasks, and the effect of a shutdown today may be the more far reaching because of the greater use of mechanisation. Those responsible are fully aware of the task and are fighting the uphill battle towards technical solvency; no easy task with the progressive demands for rural electrification and other new supplies. Nor does the shadow of capital economy measures help, even though actual limitation may not be appreciable.

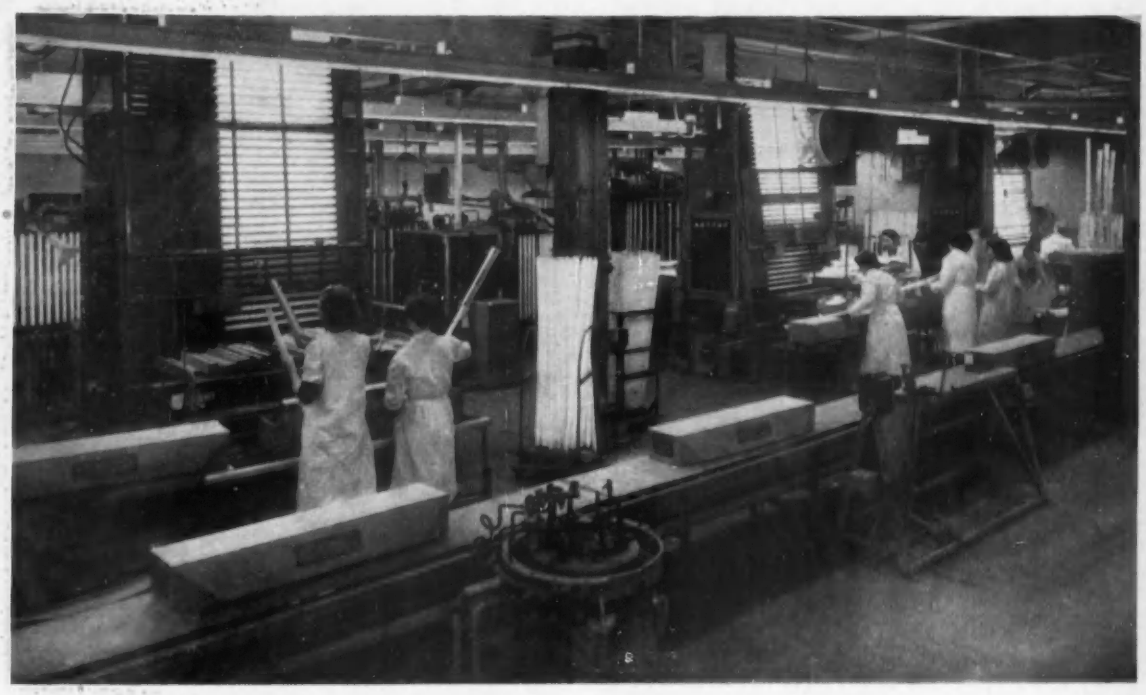
PROPER PROVISION

Such is the flexibility of application of the electric fire, that little thought is usually given to its siting in a room, and certainly special provision for its accommodation is seldom made. The position with the solid-fuel fire is far different, and the familiar, but for all that, complicated constructions made for grates and stoves are a limiting factor in seeking the efficiencies which advocates of such appliances claim for their designs. At present the free-standing fire is the favourite with the solid-fuel interests (the "improved" open fire having yielded pride of place) and the usual built-in fireplace is not at all suited to it. With this in mind, and in accordance with its duty to "finance and support such experimental work in the economical application of fuel as the Institute may consider likely to benefit the community at large," the Institute of Fuel has organised a competition for the design of suitable settings for free-standing fires, with a prize of 200 guineas in each of three sections. Each design must incorporate a hearth and flue suitable for a solid-fuel fire; and had the requirements stopped there we should not have been surprised. In fact, however, the Institute recognises that many prefer electric heating and it matches this recognition with realisation that suitable provision can improve the efficiency of the electric fire. Each design for a setting submitted in connection with the competition must have a socket-outlet provided, so that an electric fire may be installed as an alternative to the solid-fuel appliance. Moreover, some simple device must be provided for closing-off the flue when the electric fire is used. Such requirements reveal a true appreciation of the realities of domestic heating preferences.

FIGURES ON POLLUTION

Behind the quantitative estimates of atmospheric pollution that are quoted from time to time is a network of observers the extensiveness of which is seldom realised. This organisation is brought from its obscurity into brief limelight with the publication by the Fuel Research Station of a report on ten years of such observations including long term averages for all observation posts. So extensive a coverage of the country's atmospheric cleanliness is only possible because of the co-operation of local authorities and interested organisations, which is still growing. In the ten-year period 1944 to 1955 which the report covers, the number of measuring instruments in regular use rose from 200 to 1,500, and it is a measure of the growing attention now being given to air pollution, that a further 500 instruments have been brought into use since the conclusion of the period covered. The broad picture which this mass of data reveals is that taking 1939 as the base year, there has been a general increase in pollution by grit and dust, and small decreases in that due to smoke and the oxides of sulphur. In densely populated areas, the degree of pollution may be forty times as great as in the countryside; and of course, during fog the position may worsen further. Inevitably, the figures given in the report are general in character, but running through the list of observing stations, the careful attention being given in areas surrounding power stations is apparent. The C.E.A. is co-operating in such work, and when full and detailed results on the pollution records of stations more or less in open country are available, there should be positive evidence of the efficiency of the expensive measures taken in generating stations to reduce to a minimum the pollution of the atmosphere.

Meteor



Production of Fluorescent Tubes

By W. A. STICKLEY*

THE extremely long and useful life and the high light output of best quality fluorescent tubes are the features which in combination with an efficient system of distribution of the packaged lamp to traders has made this modern light source desirable for good lighting and for convenience of purchase.

It is the purpose of this article to show, by describing the manufacturing processes of one fluorescent lamp production unit, how by considerable mechanisation its product has improved in quality, and, in spite of a general increase of labour and materials, costs become cheaper to the consumer. For instance a fluorescent tube, which cost 24s. (or more) in 1946, cost 15s. 6d. in 1951 and first quality tubes are now only 13s. Mention is also made of what has sometimes been called re-processing of worn or otherwise unserviceable goods, for the question of the repair of components such as television tubes, lamps, radio valves, electric motors, etc., is a problem which arises at regular intervals over the years and it will be well understood by all that there is a connection between design, production and ultimate repair of such components.

Mechanisation and Design

Electric lamp manufacturing, tungsten as well as fluorescent, is already highly mechanised, but it will be shown later than although in the main the processing and assembly is automatic, operators are still needed to load and unload the machines. Whether we shall ever see the day when raw materials are fed into one end of the manufacturing plant and emerge as the finished product wrapped and packed ready for transhipment, with all the processing controlled only by a series of electronic equipment, is at least, doubtful. What is certain, is that the human brain, eyes and hands will always beat the electronic machines in the final appraisal of the product—that is—good design and inherent quality.

Fluorescent tube manufacturers make use of chemists and physicists who are not only capable of compounding chemicals but must be able to investigate and control the physical structure of the various components of the phosphor and other raw materials from which their lamps are made. The X-ray apparatus (Fig. 1) is an essential tool in this work. This equipment supplies much of the basic information, from which the detailed processing schedule is drawn up, of, for instance, the firing (Fig. 3) and milling of the powders which will finally coat the inner wall of the lamps.

Tubes and Coating

The processed powder arrives in the tube coating section of the main lamp production lines in a nitro-cellulose suspension which is white in colour and of a rich milky texture. The reservoir tanks of the coating machines with their in-built agitating and pumping equipment ensure that the coating will be offered to the glass tubes in perfect condition. Absolute cleanliness of the glass is essential if the coating material is to spread evenly on the inner walls of the tube and the washing-drying section deals with the first stage before coating the tube. Ordinary washing would not leave the surface clean enough and thus the tubes are passed on a conveyor through a system of heated water at high pressure followed by a hot filtered air period to ensure perfect drying. Once the tubes are hand loaded into the trays the process becomes automatic and the trays carry the tubes to the powder coating point and on through a pre-drying air-conditioned plant to

*Mr Stickley is with Thorn Electrical Industries Ltd.

Fig. 1. The large scale production of high quality fluorescent tubes is possible only if the materials are right. The X-ray equipment shown allows the physicist to investigate the structure of the phosphors to be used. Fig. 2 (right). Filamentary electrode assemblies for lamps are nowadays produced by all-automatic means but the human element is retained for some of the check testing. The operator is inspecting a greatly magnified image of a tungsten filament spiral

the roller baking machine (Fig. 4) where an operator receives the cooled tubes ready for transferring to the sealing and pumping machines. Inspection at this point is limited to a visual check to ensure that the coating quality is satisfactory. The number of people employed in actually operating this plant is very small but they are supported by a whole team of technicians, maintenance staff and research workers.

The Electrode

The almost robot-like batteries of machines which wind, measure and cut to length the spiralised filaments for lamps are too well known to warrant detailed description but it is well worth noting that in this section the human element is employed only for machine-setting. There are, of course, plant maintenance men and those technicians whose job it is to maintain the quality of the product but there are no machine minders as such. The batches of completed filaments are fed to other machines which will automatically mount the spirals to form the electrode assembly and send them on to meet the already coated tubes at the sealing and pumping section.

Lamp Assembly

Girl operators feed the already powder-coated tubes and electrode assemblies into the sealing and pumping machines but from there the machines take over complete control. The 48 lamp positions of the equipment are machine indexed so that each lamp receives attention in the correct order required to meet an extremely accurate automatic processing schedule. The electrode assemblies are fused to the tubes by a series of gas jet burners followed by an annealing period. Air extraction (or pumping) follows the sealing stage and is carried out while the tubes pass through a vertical oven at high temperature. Removal of the air from the tubes is carried out by a series of "flushing" operations with argon gas and the tube is then reading for filling. Close control of gas filling and mercury dosage is assured by electronically controlled relay devices joined by an electrical means to the machines. Sealing for ("tipping") is also an automatic operation and capping completes this stage of manufacture. The tube is then transferred to the final conditioning and testing machines ready marked with the manufacturer's brand and other essential information.

The electronic relay system which controls this latter machine is an interesting example of applied automation. The one hundred tubes each 5 ft long which this machine deals with continuously are, in turn, subjected to a series of conditioning, ageing and ignition processing stages followed by tests for striking, electrode emission, current, power and light-output tests and the results of which are "banked" by an electronic brain which controls a relay system and will reject unsuitable tubes. A trip mechanism by-passes faulty tubes to a rejection chamber for attention by technicians and thus enables corrective action to be taken immediately.

The testing machine feeds its product into the hands of girl operators who pack the finished tubes into cartons. The tubes are then transported by conveyor to the dispatch point ready for sending them to the tube holding stores where they await release by the quality control section. Quality control consists of photometry (Fig. 5), colorimetry and life testing, these sections being under the direct control of the laboratories. Samples of tubes are, however, selected from the batches for production check testing and no batch of tubes may be moved to

Fig. 3. The modern furnace room for the heat treatment of fluorescent powders. The control desk is on the left. The trolleys carrying the pots of powder material are manhandled but the furnacing is controlled automatically

stores until the batch has received approval. The designs and requirements are laid down by the laboratories and it is the laboratories who check that all of these requirements are met, but it is the knowledgeable attention to detail, of the group of skilled production technicians which makes certain that the machines produce high-quality fluorescent tubes.

The Problem of Re-Processing

When a fluorescent tube has reached the end of its natural life at 5,000 hours (or more) there does not, at first sight appear to be very much wrong with it, perhaps a little end-blackening and failure to strike and the manufacturer is often asked why he does not offer to reprocess this apparently so little damaged and comparatively expensive unit. The answer to this problem is easy, and, if it is given in the following way the customer will rarely fail to be completely convinced that it is against his interests that the lamp industry should embark on such a project.

There are three major objections to repairing fluorescent tubes. They are:

(*a*) An end-of-life fluorescent tube cannot be made to give anywhere near its correct amount of light by simply re-coating the electrodes and re-pumping, for once the fluorescent powder has become "poisoned," only by cutting off the tube ends and completely re-powdering could the full light output be regained.

(*b*) Much of the cost of a tube is in the packaging, handling, transit, invoicing, etc. Fig. 6 shows all of the main manufacturing and handling stages to the user, back to the repairer and back again to the user. It can be seen that the ratio of handling to cost of raw materials would change considerably to the disadvantage of the user.

(*c*) All tubes returned for repair will not be suitable for re-processing for many will be too end-blackened for further use or may have broken electrodes. Only by inspecting and testing the tubes individually and manually can this be ascertained. Thus there will be much wasted effort in this respect alone and losses in transit must also be allowed for.

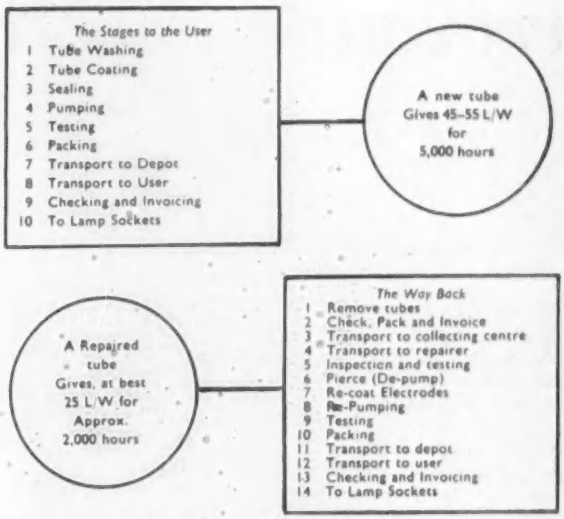


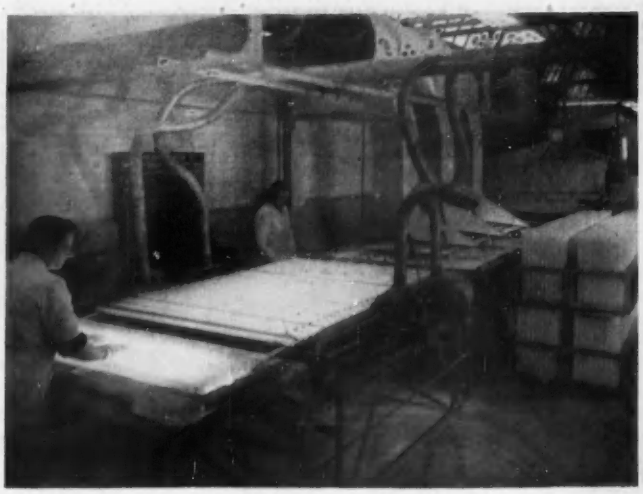
Fig. 6. The number of times that any product is handled must affect the final cost. The above tables show that in order to get a lamp to the repairer and back to the user, handling must be more than doubled. In the circles the light output and expected life of new and repaired tubes are given and on this count alone the repair of fluorescent tubes would not be an economical proposition

To sum up, it may be possible to collect a few tubes, pierce the ends and recoat the electrodes at a price less than that of a new tube, but, on a national scale it would not be practicable and the loss of efficiency (light output to power consumed) of the repaired tubes would show as a loss to the consumer.

Other industries, radio valve, television tube and others must often be faced with this same repair question but with automatic manufacture and the long-life-to-price ratio the need for reprocessing of what may well be out-of-date products which have already given long and good service disappears.

Fig. 4. The output end of one of a number of roller baker machines used in the tube cooling process to bake out the binder material

Right, Fig. 5. Measuring the total light output of fluorescent tubes. The 12 ft diameter sphere is the chamber in which all the light from the tube is collected and a known quantity of which is directed to a photo cell transmitting information to measuring equipment in the foreground



PROTECTING OVERHEAD LINES

FACTORS INVOLVED IN THE USE OF VOLTAGE-OPERATED EARTH LEAKAGE SYSTEMS

By T. C. GILBERT, M.I.E.E.

IT is rather surprising that although the industry has accepted, somewhat reluctantly in the early days, the principle of voltage-operated earth leakage protection for the interior installation, no serious consideration appears to have been given to the possibility of using this method in connection with overhead lines. The protection of overhead lines against the effect of earth fault, whether accompanied with conductor breakage or not, possess exactly the same problems as are often encountered in the interior installation, but writ large. In l.t. networks in rural areas substation electrode resistance is never absent, whilst the addition of fault impedance—that elusive factor ruining any chance of effective application of direct earthing—is always likely; non-isolation of the fault means the appearance and continuance of dangerous potential gradients at the pole electrode and possibly also at the point of contact of the phase with earth.

Overhead Line Requirements

During the Institution discussion on the proposed revisions of the Electricity Commissioners' Overhead Line El. C. 53, Regulation 12 in particular came under rather heavy comment. This reads—"Means shall be provided to reduce to a practicable minimum the risk of a conductor remaining alive after it has fallen, owing to breakage or otherwise . . . the design and construction of the system of earth connections shall be such that, when contact is made between a line conductor and metal connected with earth, the resulting leakage current shall not be less than twice the leakage current required to operate the devices which make the line dead." This means that with substation fuses rated at 60-amp pole substation electrode resistances must not exceed 1·13 ohms, assuming no fault impedance, or the Regulation is a dead letter. Distribution engineers will know just how often it is possible to secure such low electrode resistances, or if obtained, how many can pass 216 amps.

Fire Risk

The point is emphasised in the Factory Department publication, "Electrical Accidents and Their Causes, 1948," which says—"In some rural areas for instance it has been found 'economically impracticable' to reduce the resistance between the neutral point of the supply system and earth to less than 50 ohms, and it is suggested that the implications of this should be freely discussed with the consumers, contractors and the Board's safety officers, so that if the safeguard of low resistance earthing is to remain economically impracticable some other means of securing a proper degree of security from electric shock and fire should be found." The fire risk arises, of course, from the persistent flow of heavy current through the fault path by non-isolation, and the shock risk from dangerous potential gradients round the pole electrode, plus the extension of a high voltage to the whole neutral line. It is suggested here, however, that the risk of *two* potential gradients should be visualised, one at the pole electrode—for which the only sure treatment seems to be the fencing-in of the likely area—and the other at the point of earth fault, to which no similar palliative can be applied.

It is, however, in the "other means" suggested in the above quotation that interest centres, and as potential gradients may persist for a considerable time it is thought that these should definitely limit the time that a fault should be allowed to exist, with special low limits of time in connection with pole-type substations, and in any consideration of the time factor the stress to which L.T. windings and terminal connections of the transformer are subjected when earth faults occur in those units in which H.T. and L.T. metal work earth connections are separated should not be overlooked. Regulation 12 is clearly concerned with the danger of a fallen conductor remaining alive, but realists will agree that there is very little chance of isolation with our present methods; although actual line breakage may be rare, occurrences such as the failure of bad joints in mid-span or the burning through of conductors at insulator supports are sufficiently frequent to cause alarm, whilst a contributory cause may be the high setting of time-delay protective gear when prospective fault currents are high.

A Chance of Isolation

In the case of a conductor on the live side of the break falling upon a well-earthed metal roof or into a contaminated pond there might be some chance of isolation with 60-amp substation fuses if the electrode did not exceed 2 ohms; with even small fault impedance, however, this chance would be defeated. In the event of a broken conductor lying on the ground on the side remote from the source of supply, with the lines remaining energised, this conductor may be made alive from other phases or by other transformers by feedback, and none of the measures

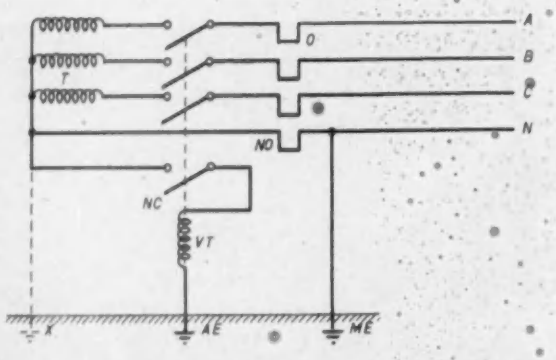


Fig. 1. Arrangement of voltage-operated circuit-breaker between transformer and lines. T, Transformer: NO, Neutral overcurrent trip: NC, Neutral contact: AE, Auxiliary earth connection for VT: ME, Main substation earth connection: X, Alternative position for HE: ABC, Phase lines: N, Neutral line: VT, Voltage trip: O, Overcurrent trips in lines

proposed in the Regulations can disconnect this dangerous line; none of our protective devices are designed to deal with this situation, but the problem is by no means insoluble.

Voltage-Operated Systems

As with the case of adequate protection against earth leakage in the interior installation the writer is convinced that many of the unsolved problems relating to the protection of L.T. overhead lines, and those mentioned above in particular, would be resolved if only we applied voltage-operated principles instead of continuing with protective systems primarily dependent upon heavy current flow, and which can always be beaten into ineffectiveness with the double barrier of electrode and fault impedance. The writer had the advantage of spending several weeks in the rural areas covered by the RWE in North West Germany in 1931/3, and took every opportunity to examine and test the voltage-operated methods employed there. These were fully described in the technical press at that time and created considerable interest, but beyond a somewhat perfunctory reference in an ERA Report, Ref. F/T122, "Safety of Consumers in Rural Areas—Second Report," have never been considered seriously as applicable to L.T. lines in this country. However, in the last quarter of a century a new generation of distribution engineers has arisen, which may possibly be more receptive of new ideas and methods; at least there is another 25 years' experience to draw upon, during which time our own methods have not advanced by one inch, so that a description of the voltage-operated system may yet be of interest.

Continental Arrangement

As a first step, the German engineer arranges his L.T. lines differently. Instead of vertically one above another in a four-conductor line he transposes a pair of lines at each pole, so that both for distributors and services they cross in the span. This simple change ensures that no phase conductor can fall without entangling another phase and/or the neutral line, and numerous experiments made showed the writer that if this did not occur in the span in which the conductor broke it did in the next one, due to the conductor pulling through the insulator binding. No line except the neutral can fall clear to the ground, so the first chance of isolation is by short-circuit with another phase of neutral line; the breakage of the neutral causes the voltage-operated trip to come into action, which disconnects all lines.

The writer was particularly interested in the substation circuit-breaker, shown in its relation to the transformer and lines in Fig. 1. This is equipped with five separate releases, all acting upon a free-handle common operating bar, so whatever the type of fault all phases are opened. There are three thermally-operated overcurrent trips in the phase lines, one similar trip in the neutral line—usually rated at about one-quarter of the rating of the phase trips —and a voltage-operated trip on the neutral line. All five trips are fitted with numbered indicators, visible through the front case, and in the event of operation the trip responsible advances its indicator one point, providing immediate evidence of the cause of operation, and also the number of times it has happened in the case af automatic reclosing circuit-breakers.

Fault Continuance Prevention

The object of the form of protection is to prevent the continuance of a fault—our present problem—and chiefly associated with the prevention of excessive voltages to earth; according to VDE Regulation 0140 the following are considered as such:

1. A voltage on the neutral of more than 65 V to earth, especially in those cases where the neutral is used for protective purposes (PME systems, for instance);
2. A voltage of more than 250 V to earth on the lines;
3. A voltage drop of more than 125 V to earth on the protective earthing system of the L.T. side in the event of connection to a H.T. voltage exceeding 250 V to earth.

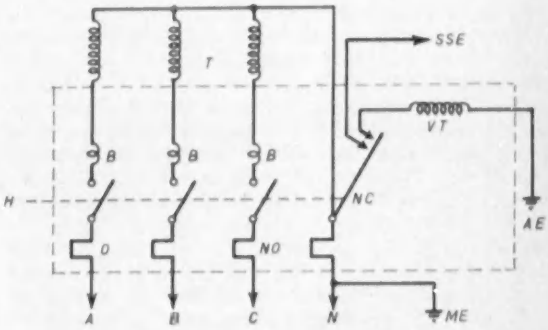


Fig. 2. Internal arrangement of voltage-operated circuit-breaker, neutral run broken. T, Transformer: B, Magnetic blow-out coils: O, Thermal overcurrent trips in lines: NO, Thermal overcurrent trips in neutral: NC, Neutral contacts: VT, Voltage trips: SSE, Connection to substation equipment metal casings, pole ironwork, etc.: AE, Auxiliary earth: ME, Main earth: ABC, Phase lines: N, Neutral lines: H, Operating handle

Excessive Voltage Circumstances

In the simple arrangement shown in Fig. 1, for example, these excessive voltages to earth may occur in the following circumstances:

1. Short-circuit between line and neutral. In this case the neutral overcurrent trip must immediately disconnect the phase lines, at least; in some areas the neutral line is also disconnected.
2. The earthing of a phase line. In this case it is possible for an excessive voltage to earth to occur both on the neutral line and the remaining phase lines, due to the displacement of the star point. In the Continental 380/220 V systems, therefore, the voltage trip VT must isolate the lines at least upon the occurrence of a neutral voltage exceeding 52 V; this value occurs when the star point of a 380/220 V system is so far displaced by the earthing of one line that the voltage of the other two lines rises from 220 to 250 V to earth.
3. By the entry of the H.T. voltage into the L.T. side. In this case all conductors will assume an excessive voltage to earth, and the voltage trip must disconnect all poles of the system should this exceed 125 V. It is considered sufficient, in this case, if the serious continuance of the excessive voltage to earth be prevented that is, if the circuit-breaker opens within 30 seconds—as the brief appearance of high voltages to earth cannot invariably be prevented (with sudden asymmetric loading of the lines, for instance).

The operational requirements for the various trips in the circuit-breaker are set out in VDE 0663/1933; standard voltage ratings are 380 and 500 V, and current ratings 60, 100, 200 and 350 amps per phase. The thermal overcurrent trips are interchangeable and it was noted that in many cases, where the design permitted, circuit-breakers were equipped with the heavier-rated contacts, even with 60-amp trips, to allow for later heavier loading of the lines and the fitting of higher rated trips; the phase thermal trips are backed up with an ingenious electro-dynamic in-

stantaneous device. The regulation requires that the overcurrent trips in the lines shall be so rated that, with an ambient temperature of 20° C and a current exceeding the rated current by 5%, tripping does not occur within two hours; with a current exceeding the rated current by 20% the circuit-breaker shall be tripped within this period. The overcurrent trip in the neutral line must be so rated that the ratio of the normal to the minimum tripping current does not exceed 1·75, the tripping time being 30 seconds.

To allow for normal loading of the neutral line during service the highest possible minimum tripping current should be aimed at for the neutral overcurrent trip; on the other hand, in view of the natural increase of voltage to earth of the neutral occasioned by loading it would seem that the lowest possible normal tripping current would be desirable in the interests of safety. However, the regulation ratio of 1 : 1·75 for the minimum to the normal tripping current fulfils both conditions reasonably well and thus makes it possible to employ an ordinary thermally operated trip for the neutral overcurrent trip. It was rare to find neutral trips rated at less than 15 amps, and with this low rating isolation of remote short-circuits was certain and independent of line impedance; whether the neutral line was opened or left intact with the operation of the circuit-breaker in all cases the neutral contacts connected before, and broke after, the line contacts.

Tests

Various tests are laid down for the tripping values for the lines which need not be repeated here, as they follow ordinary practice, but those for testing the neutral voltage trip are interesting. This trip must be responsive not only to the sudden application of voltage, but must be tested to ensure that it has sufficient power to definitely trip the circuit-breaker when the voltage is raised from zero very slowly. The following values must be obtained:—

Resistance in series with the voltage coil; (corresponding to electrode resistance); ohms	Voltage	Tripping time; seconds
0	40	—
50	65	0·2—30
50	125	0·2—10

Fig. 3. Necessary neutral voltage trip values

It should be pointed out that the tolerances of 0·2 to 30 seconds and 0·2 to 10 seconds have been instituted in view of the differing conditions of service. Where the longer tripping time is employed selectivity obtained in conjunction with fuses connected on the load side is improved; with the shorter time the protection afforded is, of course, more effective. The important point to note, however, is that under no circumstances may operation be delayed beyond 30 seconds where fallen lines or similar faults are encountered. The voltage trip coil must be capable of carrying its minimum tripping current (usually about 15 milliamps) continuously without suffering damage.

Delayed Action

It will also be noted that the voltage trip has a delayed action, in contrast with voltage trips used in the interior installation, where their action is instantaneous. The delay is obtained by a simple system of balance weights, easily adjustable on site, which oppose any rapid entry of the trip armature into the magnetic gap of the coil, unless the voltage applied is excessive. By this means the neutral voltage is kept under close control, and this method of protection would seem especially applicable to the PME systems now being introduced in the South West and elsewhere, with which high neutral potentials are extended on to the frames of consumers' apparatus.

The simple internal arrangement of the circuit-breaker is shown in Fig. 2, from which it will be noted that additional earth connections on the neutral would have no adverse effect upon operation. In fact, it was common to find in the areas visited that in some cases a second earth connection to the neutral had been made at the remote end, and sometimes others in between; so far as the writer could gather, this was due to the existence of two schools of thought regarding the isolation of a simple neutral break or disconnection, without contact with other lines or ground. One relied upon asymmetrical loading of the lines to produce the essential neutral voltage but the other thought that the neutral should be additionally earthed at some point remote from the source of supply as making isolation more certain; the point remained unresolved, but the weight of opinion was definitely on the side of two or more neutral earth connections.

System Development

It is thought that the development and employment of similar simple protective devices in rural areas in this country might provide the effective "other means" suggested in the Factory Department comment quoted above, whilst at the same time costing considerably less than what is now spent on attempts to secure and maintain comparatively low resistance earths at pole-type substations, and which, all agree, cannot effectively provide the protection sought, plus the cost of fencing-in likely gradient areas and paying compensation for dead cows. As will have been gathered, with voltage operated methods low resistance electrodes are not an essential part of safety, whilst the auxiliary earth electrode may possess considerable resistance without detriment. Another advantage is, as with the interior installation, the simplicity and ease of tests of security; the writer was allowed to make several checks by means of short-circuits on the lines, the application of earth contacts, etc.—he was not permitted to break a neutral, but the effect of this was demonstrated at the Wesel station—with one man left at the substation and the hall light of a near-by farmhouse used as a pilot to indicate times taken for release. One was left with the conviction that voltage-operated methods surpassed our own at least in efficiency as to make the latter appear obsolete, and this was over twenty years ago! Regarding cost, the present price of a 4-pole circuit-breaker with the five trips described, rated at 200 amps per phase, is DM 372, list; at the present rate of exchange this is about £31—rather high, apparently, but how many pole electrodes cost less during the course of their life if maintained at the Regulation requirement resistance?

Conclusion

In view of the mounting difficulties with direct earthing it would seem that "other means" will eventually have to come under consideration if the complete and reliable protection of L.T. overhead lines is to become an accomplished fact, and, as with the interior installation, voltage-operated methods appear to hold the key to success. Space will not permit an examination of the enhanced protection against fire with voltage-operated methods as compared with heavy current protection, but this will be apparent to the reader. Fire risk may be even more important in the rural area than shock risk, and methods that are able to eliminate both are well worthy of our investigation; as they are applicable to both normal and PME systems of distribution they should meet most of the outstanding safety problems.

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

"Engineering Not Enough"

IT is interesting to compare the view that trade union leaders, accountants or generals can be suitable for managerial positions within the Supply Industry—that technical training is not necessary—with the attitude in the U.S.A., the mainspring of management practice. We find that there the manager is required to have all-round practical experience within the particular industry, often obtained in that very same company he is managing, and that this tendency will be even more pronounced in the future.

It seems a reasonable requirement that a manager should have a working knowledge of what he is managing, irrespective of the capability of his executives to advise him. I am prepared to admit that engineers do not automatically become the best managers, but, it is an engineering industry and I suggest that a key to filling top posts could be in putting into practice Mr D. Cleghorn Thomson's "Managers in the Making" proposals.

An independent responsible body only has the right to admit engineers to full professional status, in itself an acknowledgement of a level of responsibility held, and one of the props of the Management Profile.

ASS/BIM,
LONDON, W.9.

Connexion or Connection?

I THINK I can relieve from pain those normally educated people, who, according to Mr D. S. Barwell's letter in your issue of the 1st December, are hurt when they see the word "connection" so spelt (or spelled).

Both spellings are permissible, the one as a derivative from the past participle of the Latin verb, the other considered possibly as a derivative from the English word, "connect," but certainly by common usage since the middle of the eighteenth century.

The spelling, "connection," has been used by bishops, statesmen, scholars, poets and novelists, as for example, Joseph Butler, Morley, Bryce, Chesterfield, Jowett, Macaulay, Smollett, Thackeray, Trollope, Sheridan, Byron and that great master of the English Language, Sir Winston Churchill. I am satisfied to follow the example of these people, without enquiring into their education.

I also draw the attention of Mr Barwell to the fact that the Latin irregular verb is "conegio," and not "connegio" and its past participle is "conexum" and not "connexum."

A. E. Gaster,
LONDON, N.W.6

Earthing Tests

I HAVE noted with much interest the remarks in Mr McCormack's letter and I agree with him, but my letter was pointing out the problems which will arise from the earth-fault loop impedance test used in conjunction with Reg. 406.

First, we accept the fact that the earth-fault loop impedance test is the only effective method of testing the path to be traversed by the fault current, for not only does it test the continuity resistance of the earthing conductor on the consumer's premises but the resistance of the earth electrode on the consumer's side, the supply side, and the resistance of the mass of earth between the supply plant electrode and the consumer's earth electrode.

Now Reg. 406 demands that the earthing arrangements in a consumer's installation shall be such, that on the occurrence of a short-circuit between phase and earthed metal, a current corresponding to three times the rating of fuse protecting the current can flow so that the faulty circuit is made dead. This is of course necessary to ensure a margin of safety, but I do feel strongly that there should be a limit to allow for human error, e.g. incorrect fusing. I would suggest a maximum earth fault loop impedance of 1·3 ohms based on the fact that the maximum fuse normally installed in the consumers premises (domestic) is 60 amp. Allowing an impedence of 2·7 and over leaves the installation open to situations as quoted in my last letter.

However, I am not in full agreement with the criticisms raised by Mr Smith. Unfortunately space will not permit me to give much detail in reply. I cannot accept that it is reasonable to assume that if the consumer's "mass earth" in a district is efficient at all times, then it should be possible for the supply authority "mass earth" to be similarly efficient. My comment to this is take nothing for granted.

If one obtains an earth-fault loop impedance of 2·6 ohms, quoted in my example, it does comply with regulation 406. However, I share Mr Smith's views on this point. The final point about consumer B. Mr Smith has not included the resistance of the supply authority's earth electrode which I quoted as increasing from 0·2 to 5·4 ohms, thus making a total impedance of 8 ohms. Therefore, it is clear that the 30 amp fuse would hold the fault current and the fact that the consumer's earth is more effective than the supply authority's and would result in that particular phase taking earth potentials whilst the potentials of the other lines to earth, would raise to the value equal to line pressure.

Thomas A. Stopford,
GRAVESEND.

* * *

I READ with great interest the remarks made by Thomas A. Stopford, Gravesend, in Readers' Views, 8th December issue of ELECTRICAL TIMES, based upon and involving Regulation 1005-B, 12th Edition, now superseded by 13th Edition of "Regulations for the Electrical Equipment of Buildings" (I.E.E.).

As a general rule, most contractors have experienced difficult situations with regard to "earthing" in some rural areas, especially where the supply is by overhead lines, and the local transformer strapped to the pole, or fixed at ground level. It must also be remembered that fortuitous "earthing" can be present in other places than rural areas. Before a contractor can estimate for the installation in a case of this nature, he must decide upon what the "earthing" situation will warrant to make it in strict compliance with the regulations, under such adverse conditions as drought.

If an earth-leakage circuit-breaker or breakers are necessary they should be installed, but they cost more than the ordinary common or garden switch-fuse. This cost must be borne by the consumer as it takes the place of the usual switch-fuse which is part of his electrical installation. The question of cost does not enter into the matter where life, risk of fire and accident are concerned, as these are all taken care of by the I.E.E. Regulations.

With reference to the replacement of the 30-amp h.r.c. fuse by a 60-amp by the Supply Authority. This will

usually be given careful consideration by the Authority and if considered necessary the installation will no doubt be inspected to ensure that the setting of the earth-leakage circuit-breakers is satisfactory. If this is not the case, the necessary requirements will have to be met by the consumer.

In conclusion, may I add that the Supply Authorities are most helpful in this direction, both theoretically and practically with regard to fortuitous earthing in any particular area, and this, in my opinion, is absolutely essential in order that the best (and less costly as far as possible) method or methods are adopted. Therefore, by working in harmony and conjunction with each other, a satisfactory job results.

J. H. Robinson,
GLENROTHES, FIFE.

Lighting in Love Lane

I AM surprised that the No. 3 Portsmouth Sub-Area Manager seems to think that the only alternative to sodium lighting is moonlight. Has he never heard of filament lamps? These are not nearly as efficient as mercury and sodium "Chastity Lighting," but is that always the most important consideration? For arterial roads, perhaps so; but for lighting Love Lane and any other place where people look at each other as human beings and not as potential obstructions, the old fashioned filament lighting is much to be preferred.

Petersfield is very commendably showing a red light to the indiscriminate use of an ugly modern gadget and No. 3 P.S.A.M. should respect their artistic sensibility instead of scorning it.

E. W. Crew,
BROXBOURNE, HERTS.

Electric Drying for Crops

THE application of electricity for crop drying is a subject on which widely differing views are held, and on which much work, some of it inconclusive has been carried out. A critical review of the subject is now generally available in the form of an E.R.A. Report, Ref. W/T25, "The Applications of Electricity to the Crop Drying on Farms," by P. Finn-Kelcey, and is available from the E.R.A. at Thorncroft Manor, Dorking Road, Leatherhead, Surrey. Price 24s. This report begins by surveying the general problem of crop drying from the aspect of the farmer and the section devoted to this is divided into two parts, one concerned with herbage and one with grain and seeds. The second part is concerned with the principles of crop drying and gives six possible methods analogous to evaporation from an open bowl, listed as (1) heating the water contained in the bowl; (2) heating the air surrounding the water to increase its moisture carrying capacity; (3) enclosing the whole in an airtight container and exhausting some of the air; (4) treating the air with a moisture absorbed material; (5) increasing the rate of air flow in contact with the surface of the water and (6) cooling the air to its dewpoint temperature and condensing the moisture before reheating. Practically all farm crop drying machinery depended on methods (2) and (5), although in the future method (6) might be used by the employment of a heat pump unit.

In crop drying in the first stages the analogy of the open bowl or water bath held good as moisture was readily available and came to the surface at about the same rate as it was evaporated. After a time, however, the moisture failed to reach the surface at this rate, and the rate of drying fell off uniformly, finally the moisture was taken off at a rapidly diminishing rate and no further drying took place.

The solid or liquid fuel furnace for grass drying could not be directly replaced economically by an electric heater of equivalent output. There were, however, several attacks whereby electricity could be used to advantage such as centrifuging, crushing, chopping and forced-draught drying. The report also gives several pointers as to the methods to be adopted to use electric heat to its best ability, and details are provided of various grass drying systems including the American system of barn bay drying by forced draught and unheated air.

The necessity for grain drying was a direct consequence of the increasing use of the combine harvester. This produced grain which in the great majority of cases required additional cleaning and drying before it could be stored and sold. The tendency for bulk silo storage of grain had also made it necessary for drying to be carried out. It thus appeared that farmers who intended to use a combine harvester for any but the smallest acreage of cereals would have to install or have access to some form of drying plant.

Three systems of artificial drying were possible—continuous drying, batch drying in bulk and batch drying in sacks. The continuous drier in various forms had been the only type available for farm use until the ventilated silo came into being in the late 1940's. The electrical load for air heating on those driers was from 150 to 300 kW, although in 1943 the Bedford Corporation Electricity Department began experiments which recorded 30-35 kWh per ton dried for each 1% of moisture removed. The cost to the farmer was high and the thermal efficiency of this type of drying was thought to be too low for electric heating to be employed with reasonable economy.

Batch drying in bulk (ventilated silos) has become very popular recently. In this method heated air was blown through the bulk grain. Difficulty could, however, be experienced in control of heating as the humidity of the atmosphere was an important factor. The selection of fans suitable for the duties they might be called upon to perform was also an important consideration.

Platform drying had advanced rapidly of recent years. This form of dryer had been the subject of valuable and intensive development work. In essence it consisted of a platform containing grilled openings over which the two bushel bags of grain were laid. Air was blown into a plenum chamber of 12 to 18 in. depth below the platform and passed upward through the bagged grain. A 25° F temperature rise was imparted to the air and for 1% per hour moisture removal about 140 cu ft of air per minute was required per sack. Tests on this system had been carried out by the South Eastern Electricity Board and had been published in an earlier E.R.A. Report.

In conformation with its purpose as a "critical review" the report continues by giving some information on miscellaneous types of grain dryer; the use of grain driers for other crops, and the application of ventilated silo equipment. Seed drying—a specialised trade—and hop drying, which has peculiar difficulties, are considered individually.

In conclusion it is pointed out that when electrical power is to be applied to farm processes it is usually necessary to develop new techniques. It could be said that, except in the case of drying small quantities of a high-priced material, the application of electricity would tend toward bulk drying over relatively long periods.

Protective Equipment for Electrical Systems

PART 3—A REVIEW OF THE DEVELOPMENT OF PROTECTION TECHNIQUES AND APPARATUS

By W. CASSON, M.I.E.E., *Head of Transmission Design Engineering Branch of the Chief Engineer's Department, C.E.A.*

THE importance of generating units, especially at times of peak load demand, justifies the greatest care in the choice of method of earthing the generator star-point. Certain incidents in which the consequential faults and damage when an earth fault occurred on the l.v. circuit of generator/transformer units earthed in the conventional way through a v.t. were most serious, resulted in a change of policy to that of earthing through a resistor of low surge-impedance and of moderately low value (e.g. 22 ohms for 11·8 kV 60 MW generators) and providing high speed sensitive earth fault relays operating from a current transformer connected in series with the resistor.

Protection against loss of excitation or of load and the shutting down of a generator for a busbar fault are not always considered to be essential in modern practice.

Busbar Protection

There were very few installations of busbar protection prior to the inauguration of the Grid. Busbar faults were regarded as a rarity and when they did occur in generating stations it was expected that the clearance of the faulty section of switchboard and restoration to normal conditions could be effectively dealt with by the station operating staffs or by overcurrent relays. With the installation of the Grid it became apparent that interconnection of generating stations by the Grid was a factor which did not allow sustained faults to be easily detected and dealt with by action by the operating staff, and that automatic methods were more desirable.

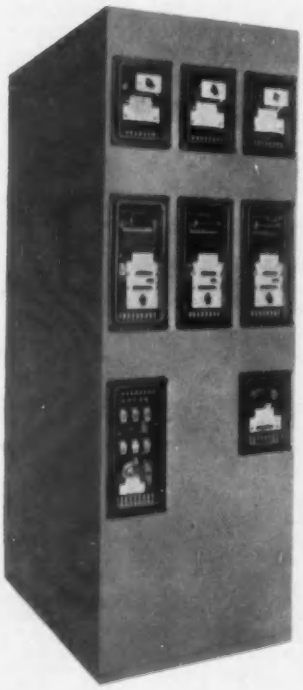


Fig. 3c. Complete installation of phase-earth fault distance protection using "mho" relays

The C.E.B. applied busbar protection to some of the main transmission switchboards as early as the 1930's but it was not until some extensive shutdowns and fires on metal-clad switchboards had occurred during the 1930's that a boost was given to busbar protection and the manufacturers began to develop schemes which gave fast clearance with discrimination between sections of busbar.

The C.E.B. gave much attention to this matter and eventually made a decision to provide busbar protection for all new major switchboards. A code of practice was prepared in which consideration was given to the number of lines of defence to be employed, the layout of wiring, the sensitivity and stability limits required and facilities for testing. The code recommended protection against earth faults only for cheapness and simplicity and because of the small risk of faults occurring free of earth.

Two lines of defence were stipulated, one which operated for a fault anywhere on the whole board and the other only for a fault on the section of busbar concerned.

Many and various schemes have been developed including straightforward Merz-Price current balance systems, earth fault directional relay systems, phase comparison systems with ultra high-speed relays and others using biasing arrangements and very sensitive moving-coil relays. Frame leakage schemes have been developed for metalclad gear and "Forrest" flashover schemes for semi-indoor types of switchgear.

A considerable amount of experience has now been obtained with busbar protection but the performance of equipment in service is not as good as was expected. Although many of the design weaknesses were discovered by elaborate heavy current type tests at the manufacturers' works, some of the equipments have given trouble in service on complex faults and under conditions of transformer magnetising in-rush.

The introduction of airblast switchgear using one set of current transformers has produced complications in busbar protection schemes where there are circuit-breaker by-pass facilities and it may be necessary in future to consider whether it is desirable in some cases to protect against phase-to-phase faults as well as earth faults; and also whether it is necessary to have two lines of defence in all cases, or could one be omitted to cut down the cost. Many of the schemes of busbar protection in use give a measure of phase-to-phase fault protection by the use of summation transformers although their main purpose is to ensure stability on external phase-to-phase faults. In planning the connections to double-busbar transmission switchboards, circuits are so arranged between the sections that the outage of a section due to a busbar fault will not normally have serious repercussions on the system. One thing is certain and that is that busbar protection is essential for large and important switchgear installations, as some recent busbar faults in which busbar protection was not in commission have shown.

The indications so far are that modern Merz-Price schemes alone are able to meet all the requirements of speed of operation and high stability.

Sustained Faults

In designing the transmission system consideration is being given to the provision of a means for clearing a busbar section when a sustained fault develops as a result of failure of a circuit-breaker to trip when its main and/or back-up

protection operates. Some consideration has been given in America also to this question for it is realised that as short circuit levels increase it becomes even more essential to clear all faults as quickly as possible; otherwise instability will result with the risk of extensive outages.

On the Continent, clearance of busbar faults is left to the distance protection of the circuits connected to the switchboard operating on its second stage. However, experience has shown that this is not always satisfactory and there is now a tendency towards the installation of discriminative busbar protection.

Busbar protection and protection against sustained fault are the most difficult kinds to install and maintain, and meticulous care has to be taken in the process. Supervisory schemes which check the integrity of the connections to the current transformers and which enable certain types of wiring faults to be detected before causing trouble, have been installed on some equipments.

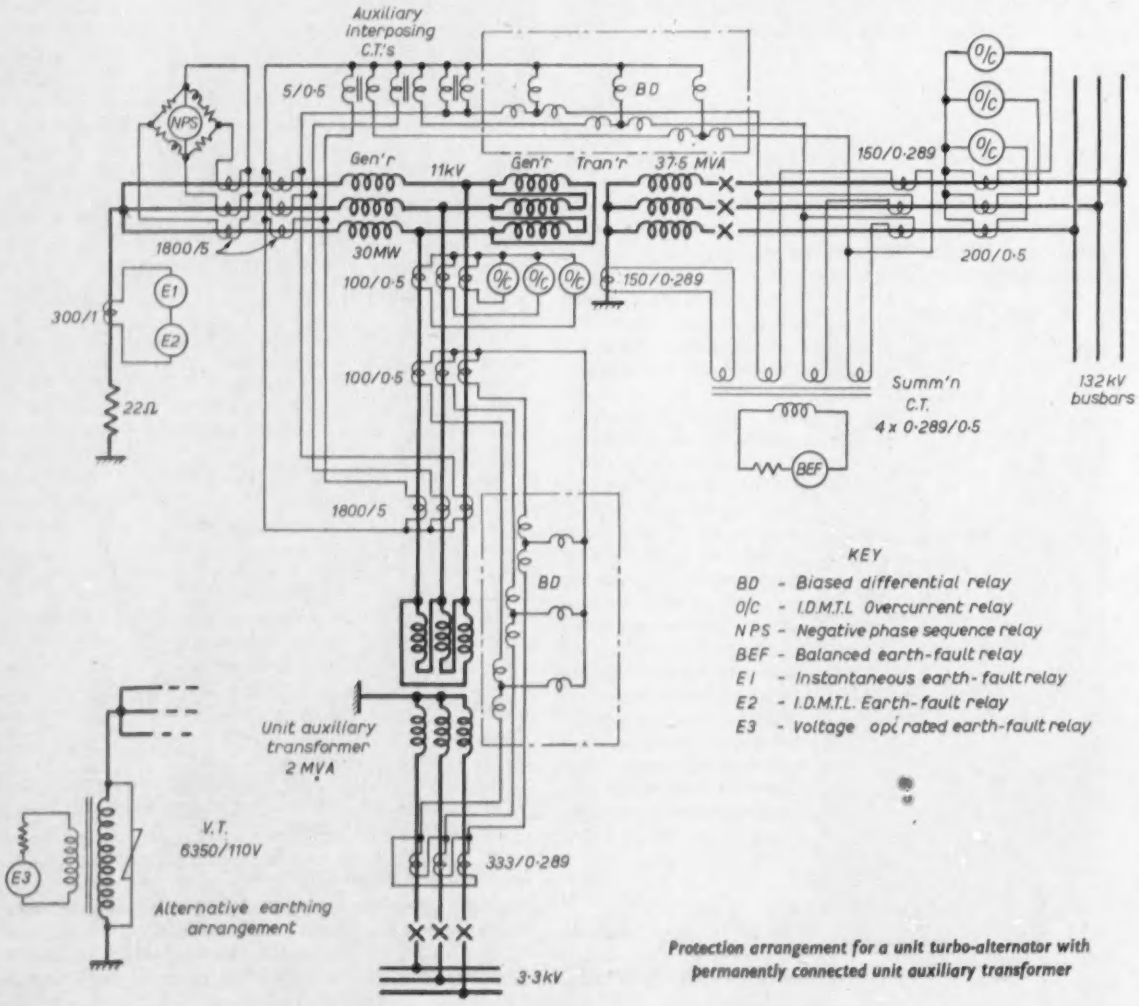
Motor Protection

Induction motors at starting and during voltage fluctuations have an in-rush current condition which as in the case of transformers produces complications in the protection. Motor protection requires to be cheap and simple and to attain this objective it is sometimes worth while accepting some inability of the protection to deal with certain types of fault.

Under-voltage relays with a time lag are still in common use but these often give trouble on system disturbances. Although they are essential for some types of motor it is questionable whether they are essential for direct started types. Fuses for small motors and high set instantaneous relays for larger motors provide satisfactory protection against short circuits, while thermal time delay overcurrent relays can deal with overloading. Relays are available which give effective protection against unbalanced currents in addition to thermal time-lag overload protection, and these are widely used on the larger motors.

Testing of Protective Gear

In the early days works tests on relays and protective gear were rather inadequate and testing on site was little better, with the result that the general performance of protective gear was poor. In the 1930s the larger electricity supply undertakings, consultants and the C.E.B. began to allocate staffs to specialise in protective gear and give their whole time to overseeing its design and to its installation and maintenance. As experience was gained the protective gear performance improved and these staffs, collaborating with the manufacturers, enabled much improved schemes of protection and equipment to be provided. Methods of testing have now been developed to such an extent that most protective schemes can be effectively tested on site. The leading manufacturers have installed heavy current testing plants for



Protection arrangement for a unit turbo-alternator with permanently connected unit auxiliary transformer

staging type tests on new protective schemes so that the performance of these schemes can be known under most conditions of operation.

For a number of years at transmission stations, facilities, usually in the form of a multi-contact switch, have been provided on circuit protection panels for disconnecting the relays for testing purposes. In the test position the relays are disconnected from their normal c.t., v.t. and d.c. supplies, the c.t. circuits are short-circuited and the relays connected to a set of terminals or sockets for connection of testing equipment.

For routine tripping tests on relays consideration is being given to the operation of the relays electrically through a simple multiple socket instead of hand operation which requires removal of the covers.

Testing facilities like those described above, assist the protective gear engineer considerably in carrying out maintenance work and no doubt in the future many more facilities for testing and supervision will be provided.

Routine tripping tests are carried out regularly on relays both on the transmission and the distribution systems. According to the records of one Division who carry them out three times a year, the tests reveal on an average about 15 cases per year of potential failure to trip of a circuit-breaker for various reasons which shows the importance of such tests and the need for vigilance.

Small Wiring and Relay Accommodation

In the early installations of protective gear where the switchgear was of the cellular or cubicle type, the relays were invariably mounted on open-back control panels and the relay terminals and small wiring were exposed to dust and condensation and hence liable to deteriorate. In addition, multicore cable terminal boards were usually positioned at the bottom of the panel which made disconnecting difficult and sometimes dangerous. Obviously the designers had not taken into consideration the fact that maintenance and fault investigation would be necessary. The same criticism applied to the early installations of outdoor switchgear; junction boxes were very congested and a large number of bolts had to be undone in order to gain access. Also they were, as a rule, unventilated which resulted in deterioration and other troubles due to condensation. In metalclad switchgear installations the small wiring congestion coupled with the prevalent practice of mounting relays on swinging panels underneath the circuit-breaker tank created nightmare conditions for the protective gear engineer. So long as the protective installation for a circuit was confined to a single relay for the main protection and a back-up overcurrent relay, there was much to commend the practice of mounting the relays on the control panel; but when the protection required a large number of relays and with longer distances between the switchgear and control panels, the advantages of mounting the relays on separate panels became obvious.

Before the last War, the C.E.B. issued a Small Wiring Code of Practice based on more than ten years' experience with the Grid. In consequence over the last 20 years much progress has been made in this matter and modern installations are easier to test and maintain. Fig. 1*a* and *b*, in Part 1, shows a very early installation contrasted with a modern one. Junction boxes are often provided with sliding lids and adequate ventilation; relay cubicles are segregated and designers give more attention to the layout of the installation to facilitate the work of the protective gear engineer. However, there is still room for improvement as is shown by the large number of cases of inadvertent tripping of circuit-breakers resulting from defects that could be avoided by better design.

The early forms of relay were in the main small contactors and adaptations of the integrating watthour meter. Their V.A. consumption was high and the speed of operation under the best conditions was low by modern standards. Developments after the first World War resulted in improved designs of induction and attracted armature type relays, with plug bridges which enabled the setting to be readily altered on load without breaking the c.t. circuit, and the time-current characteristic in induction type relays was greatly improved by the introduction of the definite-minimum feature. Various types of distance relays were developed to meet the requirements of the projected Grid system. In the course of time speed of operation was improved and such troubles as armature "sticktion", unsatisfactory contacts and flag indicators were greatly reduced. However, with high speeds of operation the danger of vibration causing maloperation was increased and this is still an acute problem requiring serious attention. The same trouble is prevalent in the U.S.A. where various means of overcoming it, such as resilient mountings, are being given urgent consideration.

There has been a tendency in the past for the respective designers of protective relays and telephone type relays to work independently and for the former to fail to benefit from the very successful developments which have been made in the telephone type relays but there are signs of a change in this situation. Figs. 2*a*, *b*, *c* and *d*, illustrate an early and four modern versions of typical relays.

The practice established up to the present is to house the main elements of the protective scheme each in a separate case, but developments abroad have shown there is much to be said for assembling all the relay elements in one large case and thus greatly reducing the amount of external wiring and connections. Figs. 3*a*, *b* and *c* illustrate two versions of distance type protective equipments. During the past few years designs have been introduced in which the relay elements can be unplugged and withdrawn for inspection or replacement without the necessity of dismounting the relay or requiring the circuit to be taken off load.

Since the last War electronics have made considerable inroads into the protective field and there appears to be plenty of scope for this important innovation. It is not improbable that in the future the mechanical type of relay will disappear. Last year a paper was published by C.I.G.R.E. describing a protective scheme, operating in less than 1 cycle which did not include a single mechanical relay even to the tripping of the circuit-breaker, all the measurements and operations being effected by means of electronic devices. It appears that the protective gear engineer in the future will have to interest himself much more than he does in electronic techniques.

The author wishes to thank the Chief Engineer of the Central Electricity Authority for permission to publish this article, and Mr M. Kaufmann for his assistance in its preparation.

(*Concluded. Parts I and II appeared in our issues of* 15 *and* 22 *December respectively.*)

SCIENTISTS AT SEA

INCREASING facilities are being provided by the Royal Navy for scientists, designers and others concerned with the development of new equipment to spend time at sea. These visits are believed by the Controller of the Navy to pay handsome dividends as the user problems can be investigated on the spot. During the past 18 months the Fleets have been able to accommodate about 100 civil scientific officers in various ships for periods varying between four days and four or five weeks. The scientists are drawn from Ministry of Supply establishments which are responsible for most of the airborne electronic equipment for the Navy, and from industrial firms engaged on Admiralty work. It is hoped that sea-time of civil scientists and designers, at all levels, will become an increasing feature of Naval planning.

notes on wiring

by Megohm

AS the year draws to its end I, like many others, reflect on the happenings of the past months in the electrical industry. I have seen many things happen which please me, and in my previous Notes I dealt with matters which affect us all, and would suggest that in 1956 we pay particular attention to safety.

There has been, during the past year, a really extensive drive to demonstrate the usefulness of the 13-amp switch-socket and ring circuit. Slowly, but surely, the architect is becoming increasing aware of it as a most economic method of providing a house with the number of sockets to serve the ever-increasing electrical commodities on the market today. Manufacturers of accessories are assisting in the education of the public by producing leaflets and diagrams. The firm who originated the idea of presenting a leaflet on the 13-amp ring circuit has now produced a small book which not only covers this matter, but illustrates the various accessories used on such a circuit and describes their use. Illustrations show the most suitable places for siting the sockets in various rooms.

The book also explains the types of switches used in domestic installations and it rather pleases me to see their suggestion that, in certain instances, the lighting switch could be placed in a position *to suit the user* rather than in the conventional position at the door *inside* the room.

Mention is made also of the need for special precautions in bathroom installations and there is a description of the requirements for electric fires in such rooms.

A very well written book and just the thing for the young (and perhaps the old) architect. Coupled with the fact that this book is obtainable, is the knowledge that one can now see a film showing the advantages of the 13-amp ring circuit. I have not yet had the opportunity to see the film but hope to do so quite soon.

M.I.C.C. and T.R.S. Cables

Following closely on the introduction of a new hand crimping tool, the original manufacturers of m.i.c.c. cables have introduced a new line to speed up further installation. They have now produced a spacing saddle which requires one fixing screw only to hold the base of the saddle. An elongated hole for this screw allows the saddle to be adjusted easily when straightening up a run of cable. The top of the saddle is fixed by two self-tapping screws. This new saddle has been well received by the trade, and I happened to be on a site when a quantity arrived and heard first-hand, the comments of the operatives. They found it much easier to handle than the old type and, as the fixings were mostly on concrete, one less hole to plug for fixing purposes was much appreciated. The fact that adjustment was possible also pleased them for, as they explained, it was not always possible to pin-point the centre of a fixing hole and even when one did so, it was possible to come up against a flint embedded in the concrete which diverted the plugging tool. Thus the new design is a very useful addition to this system of wiring.

I had rather a poser put to me recently by a friend engaged on planning installations in huts, etc., and using t.r.s. cable. The huts are normally occupied for some months, then dismantled and moved elsewhere. During the time of occupation, use is made of domestic appliances and the accessories are mainly of the iron-clad variety, in order to withstand mechanical damage by the not too considerate occupants. In many cases the lights are individually controlled and *two* switches are required at almost every switch position. The problem arises on the earthing of the switch boxes. It appears that nobody manufactures a three-core flat t.r.s. cable *with earth conductor*. I spoke to certain people in the cable industry and they agreed that this was so. When asked for the reason why this was the case, they informed me that there was no demand.

Thinking the matter over at home, I thought it might be interesting to see if such a situation occured in my own house. The house was already wired when I moved in, and the lighting has been altered slightly by myself, but I found two instances of three-core t.r.s. being used to take the live wire, a neutral and a switch line through a wall to another part of the house. In each case a bare copper earth conductor had been run alongside the t.r.s. to achieve earth continuity throughout the installation. There must be many houses with similar arrangements in their wiring installations, and it would appear to me that a cable of this type might well be a stock article.

Hacksaw and Hot Water

I saw rather an ingenious hacksaw in use the other day on a site where alterations to the existing installation were being carried out. The saw was in some respects similar to the carpenter's saw to which three or four different blades can be fitted. The handle of the hacksaw is made of aluminium alloy and tough enough to stand up to the rough handling to which such tools are subjected at times. The saw handle is so designed that it gives a total of eight horizontal and three vertical positions of the blade. With this arrangement the blade can approach the most awkwardly positioned work with great ease. The blades are tough and "Sheffield-made" and are produced in five types for cutting metal, wood and asbestos. The price of the saw complete with one blade is 17s. 6d. and is a very useful addition to anyone's tool-kit.

I recently received some details of a novel indicator for use on a hot-water cylinder. This device consists of a 200 w.g., steel channel, stove enamelled white with a band of heat-sensitive paint along the bottom. The paint is a bright yellow up to a temperature of about 112° F when it changes to an orange-red over a range of about 50° F. Any further rise in temperature only causes the paint to become a slightly fuller red. The device, it is claimed, shows exactly how much *hot* water is available for bathing, etc., by merely comparing the contrast of the red and yellow colouring.

I have not yet seen the device in action, but if it really does its job it will prove a boon to the householder.

Changes in U.S. Motor Standard

REVISE BASIS FOR DIRECT CURRENT MACHINE DESIGN

SUGGESTED new standards for d.c. motors and generators were issued earlier this year by the U.S. National Electrical Manufacturers' Association (N.E.M.A.). A paper presented to the American I.E.E. in October by Mr J. F. Davis (General Electric Co., of America) reviews these proposals in some detail. The background to the changes in existing standards is the change-over by users of d.c. motors from factory-wide d.c. schemes running from constant-voltage busbars to variable-voltage drives, often with one d.c. generator for each motor. Less than 5% of recently-purchased general-purpose d.c. motors in America run at constant speed. Behind this change is the greater speed range obtainable with variable voltage, and economies in starting equipment and operation.

Basic to the standard is a new definition which reads "an industrial direct-current motor is a direct-current drip-proof motor having a continuous rating and designed, listed and offered in standard ratings with standard-operating instructions and mechanical construction for use under usual service conditions without restriction to a particular application or type of application." A significant change in this definition is the replacement of "open" construction by the drip-proof style.

Surveys of customer preference indicated that at least a drip-proof enclosure was required in a high proportion of applications to help protect d.c. machines, and particularly their commutators, under average factory conditions. The previous standards recognised drip-proof construction, but with a higher temperature rise and no service factor.

So far as horsepower and speed ratings are concerned, the proposed standard differs from its predecessor in not differentiating between motors for use at constant speed and those for variable speed. Such a distinction was felt to be artificial, since the construction of the two types was similar. The new standard effectively demands that motors shall be designed for variable-speed operation, and it eliminates many duplications existing in the old standard. The minimum base speed recognised by the new standard is 300 r.p.m., and the maximum 3,500 r.p.m. All motors are required to be capable of carrying a load equal to 1·15 times nominal rating when operating at base speed (known as having a service factor of 1·15). Between 150% and 300% of base speed, the service factor is 1·30.

Consideration of the predominant modern d.c. generator duty of supplying variable voltage to a motor has resulted in modifications in standard generator ratings. A new range of kilowatt ratings has been calculated on the requirements of the standard motor sizes, and these figures rounded off to convenient values have been used for generator standards. The service factor of 1·15 applicable to both motor and generator gives ample scope for the necessary rounding of figures. Obviously, the new ratings are likely to give rise to economies where the common one motor—one generator arrangement is in use. Speed ratings for the generators match the induction motor standard speeds appropriate to the probable driving machines of m.g. sets.

As a result of the change in the basis of kilowatt ratings, the list of standard sizes has an unfamiliar look. In place of the regular 5 and 10 intervals it now runs 4½, 6½, 9, 13, 17, 21, etc.

Temperature Rise

Probably the most interesting of the changes made in the new standard is the establishment of Class B insulation with 60° C temperature rise for industrial motors and generators. Previously the temperature rise associated with Class B has been 70° C for open machines and 75° C for totally-enclosed machines, but there has been no service factor. That is, nominal rating has been effectively the continuous service maximum rating. The existing definition of an industrial motor calls for Class A insulation and 40° C temperature rise. The new suggestion is a break-away not only from this practice, but also from that applying with induction motors.

The chief argument in favour of Class B insulation is that it results in a smaller machine. This not only results in obvious space saving and perhaps cost saving. It also reduces the mechanical inertia of the armature, and permits faster response to changes in control settings. This is especially important in the many d.c. applications involving frequent starts, reversals, and braking. It is claimed that sufficient advance in design technique has been made to allow these size reductions to be undertaken without loss in commutating ability.

There has been considerable development in Class B materials recently, notably the introduction of wire enamels capable of operating at Class B temperatures. This holds promise, the author suggests, of further reducing the size of machines below that required with glass- or asbestos-covered wire.

There have been several mentions of service factor in this summary. The 1·15 service factor has been part of the rating of general purpose motors for many years, its purpose being to compensate for the inevitable indefinite nature of the exact service conditions of motors. A 60° C temperature rise is recognised by the American Standards Association as the appropriate level for Class B materials used for general purpose generators and motors having 1·15 service factor. Incidentally, with d.c. machines, the service factor provides a factor of safety for operation below base speed, where the ventilation is less effective.

One of the chief concerns about the transition to this new temperature has been that machine frames would become hot enough to cause burns, or at least to throw out maintenance men relying on "feel" to detect overheating. In practice neither of these problems arise, since the frame temperature is likely to be little higher than with Class A insulation.

The changes proposed in the standard are expected to have little effect on performance characteristics, apart from a relatively large change in motor speed while equilibrium temperature is being reached.

In conclusion, some remarks on the status of the new specification seem advisable. N.E.M.A., as its title implies, is a manufacturers' association, which concerns itself amongst other things with rotating machinery standards. Other relevant standardising bodies are the American I.E.E. and the American Standards Association. The standard discussed in this article is a "Suggested Standard for Future Design" put forward by N.E.M.A.

AN EVENTFUL

Fig. 1. On 1st April the South of Scotland Electricity Board came into being. The Secretary of State for Scotland is seen opening a station

THE year that ends on Saturday has been a full one electrically. In the illustrations that accompany these notes, some of the highlights recorded in our pages are recalled. Inevitably, however, there are some events which did not lend themselves to pictures, and yet cannot be neglected even in a review of the year as cursory as this. Pride of place here must be given to the publication of the thirteenth edition of the I.E.E. Regulations for the Electrical Equipment of Buildings. No ordinary revision this: the Regulations were really thoroughly re-written.

Fig. 2. Several C.E.A. power stations were formally opened during the year. Below is seen the turbine house at Drakelow A

Fig. 3. A highly successful Summer Visit to Scotland was organised by the Institution of Electrical Engineers in May

Another contracting development which was the result of prolonged deliberations was the agreement on the formation of a National Inspection Council for Electrical Installation Contracting. This agreement was announced in February, but the Council is, of course, not yet fully operative. In March there was less welcome news, for the now familiar credit squeeze was heralded by restrictions on hire-

Fig. 4. Seen below is the model of the DIDO experimental reactor, which was amongst British exhibits at the Geneva Nuclear Conference

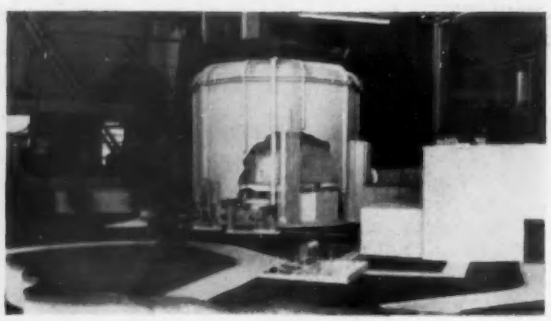


Fig. 5. In January, British Railways announced their modernisation plan. Below is seen the powerful Deltic diesel-electric locomotive

ELECTRICAL YEAR

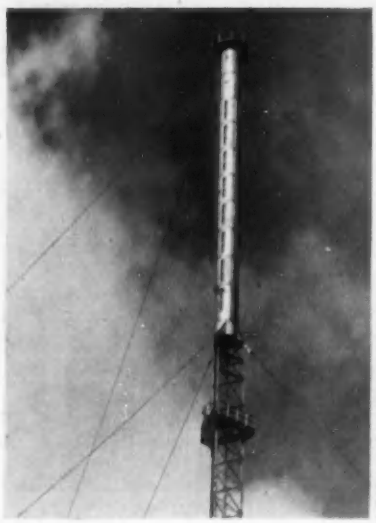
Fig. 6. The first meeting in this country of UNIPEDE opened in September with an address by Mr Geoffrey Lloyd

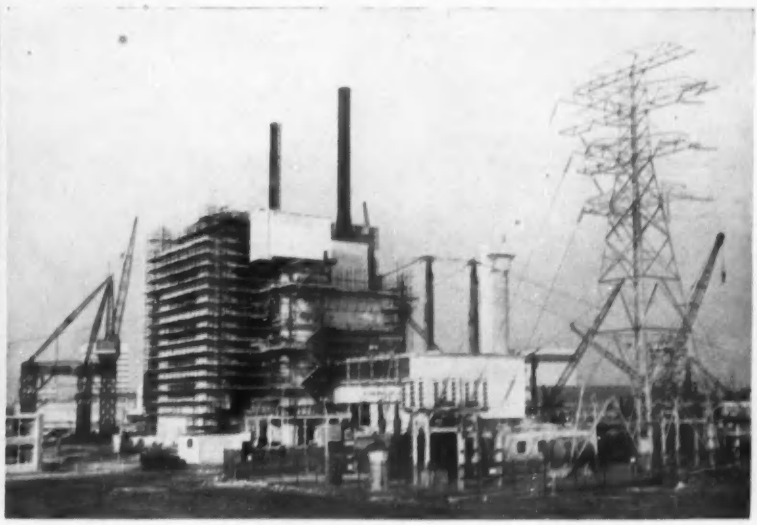
Fig. 8. Laying operations in connection with the transatlantic telephone proceeded during the year. Above is a submarine repeater being examined for standard of workmanship

purchase which inevitably hit an industry whose larger domestic products are in such demand. The end of March saw the departure from the electrical scene of the familiar "B.E.A."; the C.E.A. has continued its success.

Many other events come to mind. The resignation from E.L.M.A.; the official openings of several fine new power stations; almost astronomic prices for copper, and unavailing steps to moderate them. The kaleidoscopic pattern speaks of a busy year, holding much promise.

Fig. 7. Nuclear power was in the news throughout the year, and in February the Government announced its ambitious programme. Calder Hall seen below, right, is a prototype for the stations that will follow. In telecommunications, an interesting event was the opening of v.h.f. f.m. transmissions by the BBC from Wrotham, using the aerial below. London Airport buildings, right, bring a reminder that 1955 was a busy year for electrical installation contracting





Lift Machinery Modernisation

THAMES TUNNEL NOW USES VARIABLE-VOLTAGE DRIVE

THE pedestrian tunnels under the Thames at Greenwich and Woolwich are little known, compared with the tunnels for vehicular traffic at Rotherhithe and Blackwall. The Greenwich tunnel, however, was opened in 1903, and that at Woolwich in 1912. New lift machinery has now been supplied and installed for the L.C.C. by The Express Lift Co., Ltd., whose predecessor, The Easton Lift Co. Ltd., was responsible for the original installations at both tunnels. The original lifts were remarkable in their day for their size. In 1905 they were described as "The Largest Electric Passenger Lifts in the World."

Each lift was driven by a compound wound motor of 64 b.h.p. for Greenwich and 50 b.h.p. for Woolwich. D.C. was supplied by the Power Undertaking, although normal supplies in the area latterly were a.c. When it was decided that these installations had reached the end of their useful life, it was therefore convenient to arrange to use the available 3-phase supply. The new equipment just installed is of the Ward-Leonard variable-voltage type with generators driven by squirrel-cage motors. Each motor generator set at Greenwich consists of an 80 h.p. motor driving a 52 kW, 1,460 r.p.m. compound generator. The Woolwich sets are similar except that the ratings are 55 h.p. for the motors and 35 kW for the generators. The motor generator sets are mounted on concrete blocks with cork pad sound insulation.

All lifts are now driven by 790/850 r.p.m., 230 V, enclosed ventilated motors with ratings of 60 h.p. at Greenwich and 40 h.p. at Woolwich. Each motor drives through a 57:1 worm reduction gear and a 39 in. diameter driving sheave connected to the worm wheel by a fabricated spider. A substantial brake with self-aligning shoes operates on a brake drum formed by the coupling between the motor and the worm shaft.

A steel cubicle houses the starter for the motor generator set, comprising a line contactor and an accelerating contactor, the latter closing to short-circuit a stator resistance when the set approaches full speed. A separate cubicle accommodates the main controller with its contactors relays, protective devices, resistors and 3-phase control rectifier and transformer, which provides 100 V d.c. for all control equipment, brakes, and the fields of the generators and lift motors.

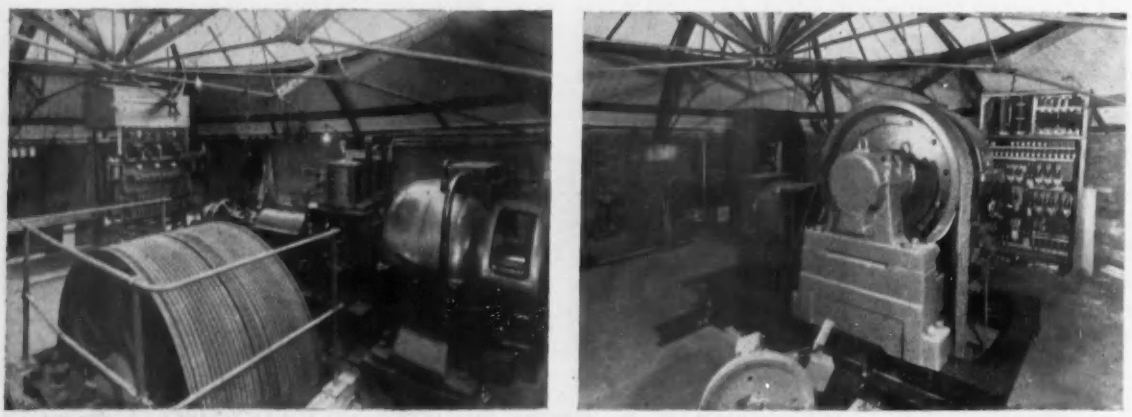
The control of the lifts, while still carried out by lift attendants, has been changed from a car controller to push button. The control station in the car includes up and down push buttons, key operated switches for car light and remote control of the motor generator, and an isolation switch for disconnecting the car control. Below the car station is situated a distribution box with hinged cover in which the car wiring and the trailing flexibles are terminated. This arrangement makes them easily accessible from inside the car for maintenance and testing.

On pressing the "up" or "down" push button in the car the hoisting motor field is restored to full strength, the generator armature circuit is closed and the generator shunt field is excited with the polarity necessary for the generator output to drive the hoist motor in the required direction. At the same time the brake lifts and the hoist motor starts.

Acceleration is effected by increasing the current in the generator shunt field by the closing of three time-controlled contactors, which short-circuit resistances in the 100 V field excitation system; and finally top speed is attained by weakening the hoisting motor shunt field. The final levelling speed and the stopping of the car are effected by magnetic inductor switches mounted on the car and operated by steel plates situated in the shaft.

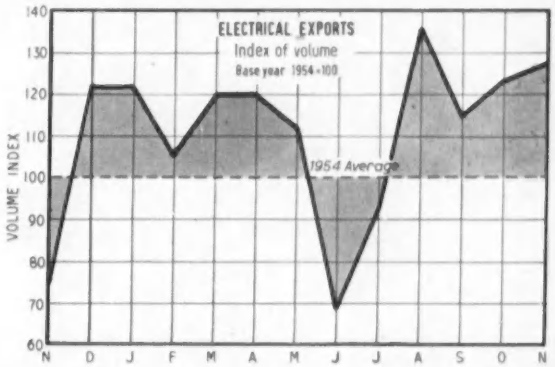
Control is also exercised by the series winding of the generator. By switching diverter resistances across the series field, different compounding characteristics are provided for top speed and levelling. This allows the deceleration brought about by regeneration in the loop circuit to be carried out in the minimum time, and ensures virtually constant final speed, enabling the car to stop accurately at floor level irrespective of the passenger load. This stopping is automatic and does not depend upon the skill of the lift attendant as previously.

All the work has been carried out under the direction of Mr J. Rawlinson, C.B.E., M.ENG., Chief Engineer of the L.C.C., assisted by Mr C. Belcher, M.I.E.E., and Mr C. G. L. Morley, A.M.I.E.E., A.M.I.MECH.E.



Left is the original lift drive installation at the south end of Woolwich tunnel. On the right is the modern installation at the same site

EXPORTS and IMPORTS

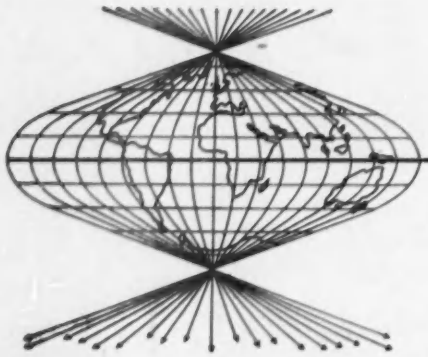


Statistics for November

THE rise in electrical exports reported during October continued into November, and, even allowing for the fall in exports likely in December, the year will have been a good one for the industry—this, moreover, despite a severe setback due to rail and dock strikes. A measure of the rise in the volume of exports is seen in the above curve of the ELECTRICAL TIMES volume index, which now stands at 127—the second highest this year. The base year has now been changed to 1954 as 100, and it can be seen that, over the year, the volume of exports has been maintained at an average level somewhat higher than that for last year. For November last year, incidentally, the index was at the low figure of 76, a result of an earlier dock strike.

Notable among the items which achieved a further increase in exports last month are motors, cables, switchgear, and radio and telephone equipment. F.H.P. motors up to ½ h.p. valued at £277,060 were sent abroad last month, compared with £252,650 in the previous year. There was a sharp drop in exports of electric cookers, but the figures for water heaters and vacuum cleaners improved a little, while the total for electric irons (£143,028) was over £21,000 up. The increase in exports of dry shavers and hair clippers also continues, last month's total of £146,497 being about 8% up on the October figure. Particularly notable too were exports for domestic washing machines and automatic power operated refrigerators. The total for the former last month was £426,947 (compared with £260,992 in October), and for the latter £519,831 against £387,063 in the previous month.

Description	Exports Value (£)			Imports Value (£)	
	November 1953	November 1954	November 1955	November 1954	November 1955
Generating Sets:					
Diesel up to 200 kW	374,635	230,180	398,342		
„ over 200 kW	307,987	133,083	393,717		
i.c. driven	42,056	11,938	29,563		
Steam turbine-driven	—	199,000	112,162	127,000	28,359
With other prime movers	43,566	28,641	24,799		
Generators	259,883	71,331	345,517		
„ parts	336,011	365,225	340,671		
Motors	889,416	668,016	1,149,748	31,273	79,842
Motor starters and controllers	259,448	111,749	220,590		
Converters and rectifiers	144,514	46,694	131,601		
Transformers	1,154,421	566,005	839,919	28,748	81,392
Switchgear and Switchboards	1,418,377	932,702	1,343,447		
Batteries, primary and parts	263,124	248,033	398,212		
Fluorescent and Discharge lamps	53,347	40,740	93,094		
Other lamps	444,880	99,152	157,529		
Radio and Electronic gear	2,452,667	1,771,587	2,658,604	746,487	1,058,263
Telephone and Telegraph Plant	1,452,972	923,065	1,567,829		
Cooking Appliances and parts	144,698	180,371	218,072		
Space heaters	24,187	39,148	31,933		
Water heaters	26,147	18,345	48,499		
Other heaters and parts	138,149	175,537	254,754		
Welding machinery	72,244	70,302	90,774	9,257	21,203
Signalling and Bell equipment	63,559	44,232	66,107		
Commercial Instruments	196,455	115,430	175,663	56,828	50,339
House Service Meters	126,487	60,395	180,233		
Electro-medical and X-ray apparatus	148,852	86,140	143,056	43,062	48,908
Fans	104,158	49,292	135,926		
Vacuum Cleaners	98,760	139,211	112,077		
Other Appliances and parts	211,268	410,203	463,317		
Portable power tools	169,195	137,695	235,417		
Washing Machines up to 150 lb	365,750	218,733	426,947		
Power Refrigerators, up to 12 cu ft	351,796	506,500	519,831		
Telephone and Telegraph Cables	772,606	294,870	722,031		
Paper-insulated Cables	980,800	311,251	1,012,772		
Rubber-insulated Cables	393,875	258,708	584,921	47,977	49,366
Winding and similar wires	111,102	72,119	166,674		
Other Cables and Wires	257,980	212,614	386,874		
Accumulators and parts	361,279	225,550	466,374		
Insulating Materials	154,729	128,685	197,557		
Electrical Ware	68,141	48,938	92,645		
All other articles	1,603,533	1,356,116	2,043,748	477,342	542,918
Total	16,537,204	11,607,526	18,981,646	1,581,954	1,960,590



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Consultants for Saskatchewan

Success has come to Ewbank and Partners, the British consulting engineers, in their venture in setting up a subsidiary in Canada. Ewbank and Partners (Canada) Ltd., of Toronto, the subsidiary, have now been appointed as consultants for the complete engineering of the initial stage of a new generating station for the Saskatchewan Power Corporation. Estimated to cost $14m, this section will comprise one 66 MW hydrogen-cooled turbo-generator with the associated 850 klb/hr boiler and ancillary plant, including buildings for two machines. The new station, to be known as Boundary Dam power station, will be constructed near Estevan, in Southern Saskatchewan, about 7 miles from the U.S. border, and close to extensive deposits of cheap lignite coal which will be obtained by the open cast method at a cost of about 7s. per ton. Ultimate capacity of the station is put at around 300 MW. For the supply of plant for the first section, which is scheduled for commissioning in the autumn of 1958, tenders are being called from firms in the U.K., Canada, U.S. and elsewhere. One problem concerning the new station related to the supply of cooling water, for the annual rainfall usually occurs over a few weeks, and the nearby river freezes in winter. It has been decided to build a Boundary Dam across a valley near the site of the power station, which will create a reservoir holding sufficient water for several years. This new station will eventually be the largest in the province. It is also noteworthy in being the first time that British consulting engineers are to be responsible for building a large steam station in Canada. For this success congratulations are due not only to officials at the London office, but to Mr K. F. Tupper, the president of the firm's Canadian office, also.

The Next Scheme?

The British Columbia Power Commission is planning the construction of a hydro-electric station in the Alberni area, at a cost of about $20 millions, we learn. Engineers of the Commission have been carrying out a survey of the Somass River and its tributaries. The proposal follows the recent announcement of the multi-million dollar expansions of Vancouver Island pulp mills.

Alcan Repeat Order

The English Electric Co., Ltd., have obtained a repeat order for a 132,000 kVA water turbine-driven alternator, from the Aluminium Co. of Canada for its Kemano power station, British Columbia. The order, worth $856,000, follows the successful operation of a similar alternator built by the company about 2 years ago.

TRINIDAD

Expansion

Pushing ahead with its widespread electrification scheme, the Trinidad and Tobago Electricity Commission expects to increase its number of domestic consumers in South Trinidad to more than 26,000 by the end of this year. The Commission's 1955 programme has so far progressed ahead of schedule, despite small setbacks usually due to weather. Agriculture and other industries are also benefiting from the electrification scheme. A second 5 MW B.T.H. turbo-alternator was recently installed at the Penal power station, providing an adequate reserve. The Commission has completed the first half of the ring between the Penal power plant and Brighton Terminal, and between the plant and Palo Seco, but the link between Palo Seco and Brighton Terminal has not yet begun.

U.S.A.

Aluminium Batteries

Aluminium dry cell batteries with long shelf life have been developed and a variety of applications studied, the Aluminium Co. of America has announced. The company said its research workers were co-operating closely with battery manufacturers, but the aluminium cell had not yet reached the stage of commercial production. In its present phase of development, an aluminium cell comparable to conventional zinc batteries for a number of applications could be marketed, it was stated. The cell's voltage would permit it to be used interchangeably in all equipment designed for the zinc battery.

NORWAY

Large Scheme

Work has started on Norway's biggest hydro-electric power project at Tokke in Telemark country. The scheme, when the first construction stage has been completed, will yield 350,000 kW of power. The work is expected to take six years. The second building stage will yield another 600,000 kW. The whole project is estimated to cost between £30,000,000 and £35,000,000. In Washington talks have been held with the International Bank with a view to obtaining a loan for part-financing of the project.

MIDDLE EAST

More Plant

The Iraq Development Board is considering the appointment of consulting engineers for a proposed Central power station in Southern Iraq, we learn. This station is initially to be of 20 MW installed capacity, sufficient for Basrah Liwa and local industrial purposes, but the specifications will provide for an expansion of the station in order to supply electricity to Amarah, Diwaniyah and Nassriyah Liwas.

Another Acquisition?

The Jordan Ministry of Education is preparing a memorandum to be presented to the Premier's office recommending the acquisition of the undertaking of the Jerusalem Electric and Public Service Corporation Ltd. It is suggested that a committee should assess the concern's assets. The memorandum also proposes that a joint organisation should be set up comprising the municipalities in Jerusalem which would take over the operation of the undertakings. It will be recalled that the concession area of the Jerusalem Electric and Public Service Corporation was arbitrarily partitioned as a result of the Arab/Israel war in 1948, since when the two sections have been operated separately. Generating plant in the Jordan area totals about 1,900 kVA. A year ago the Palestine Electric Corporation Ltd. purchased the shares of the Jerusalem company, the intention being to integrate the Israel undertaking with the Palestine. A new company was formed in Jordan to operate the undertaking in that territory.

AFRICA

Electrification

The South African Minister of Transport, Mr Schoeman, has announced that

he has decided in favour of a policy of electrification for the South African railways, with dieselisation as a stage of transition from steam to electricity. The Minister has outlined plans for the electrification of seven lines as well as the dieselisation of others.

Kariba Plan

The Rhodesia and Nyasaland Hydro-Electric Board has recommended that the height of the dam wall for the Kariba Gorge hydro-electric scheme should be provisionally set at 370 ft above the bed of the Zambesi River. But when tenders are invited for the construction work, firms will be asked to quote for an additional 20 ft, for it has been found that the foundations could carry the extra weight. The additional water storage could be extremely valuable at some future date, and it is considered advantageous to make any necessary provision in the initial stage. The Federal Government has accepted the Board's recommendation, but it is possible that further amendment may be made in the light of tenders received.

INDIA

Multi-Purpose Scheme

Work has started on South India's largest river-valley project—the Nagarjuna Sagar multi-purpose project. Estimated to cost Rs.1,310 millions, it is a joint venture of the Andhra and Hyderabad Governments. It comprises a 387 ft high dam across the River Krishna at Nagarjuna Konda, to form a reservoir of 9·3 million acre ft storage capacity. In addition to irrigating about 3·2 million acres in the two States, a total of 75,000 kW will be generated at 60% load factor, but the power generation side of the project is only scheduled for the third and final stage under present plans. Work on the project was formally inaugurated a few days ago by Prime Minister Nehru.

AUSTRALIA

Increase for Victoria?

The State Electricity Commission of Victoria has applied to the State Government for consent to increase electricity tariffs in the New Year. In some quarters, it seems, however, that there is dissatisfaction with the explanation of its financial position put forward by the Commission. In its statement, the latter explained that revenue rose by £2¼ millions in the year ended June 30 last, but expenditure rose by almost exactly £3½ millions. As a result the profit fell from £1,859,494 to £1,140,390. An increase in wages and salaries during the past financial year would cost the Commission more than £1 million for the full twelve months of the current year. There were also additional interest and other charges to be met for capital works under construction which were not yet earning revenue. In addition, there was a need to hold reserves in the business funds to help provide finance for the construction of power and fuel projects that were vital to the continuity of electrical services. The last increase in tariffs took place in July, 1952, when they went up an average of 16s. per quarter, but in July, 1954, they were reduced by about 3s. per quarter. That reduction had been based on the assumption (since proved incorrect) that by now costs would have been more stable.

NEW ZEALAND

Water Power

A chain of hydro-electric stations may be established on Bay of Plenty rivers, in New Zealand, if present plans materialise. Ministry of Works engineers have started investigations on the site of one of four dams that are proposed for the Rangitaiki river. This is below the Waiohau valley, near Te Teko. A second party will soon begin a similar detailed investigation near Murupara. The final scheme is expected to provide for hydro-electric stations on the Whakatane, Waimana and Motu rivers as well as the Rangitaiki. For the survey work involved staff has been recruited in England. Mr A. D. Benham, investigating engineer for the Ministry of Works, has said that the Bay of Plenty area is quite mountainous country, the catchment being reasonably stable with a fair run-off of water. It was likely that the proposed stations would be reasonably large.

JAPAN

H.E. Scheme Proceeding

Engineers recently closed the sluices of the Sakuma dam, in the Shizuoke Prefecture, one of the largest engineering projects in the Far East. The concrete work of the dam has taken three years to complete. Approximately 450 ft high, the dam blocks the flow of a mountainous river, which is to be utilised to generate 350 MW, mainly to be supplied to Tokyo. The lake formed will have a storage capacity of 330m cu metres, which will also be utilised for irrigation.

NEW STATION FOR CAPE TOWN

(By a Special Correspondent)

THERE is now every prospect that work will be commenced in the near future on Cape Town's new municipal power station to be built at Athlone, a few miles from the centre of the city. The approval of the ratepayers has been obtained for raising a loan of £7 millions for the first section of the scheme and the sanction of the Administrator is now awaited so that the project can proceed. The need for the new station has in the main been brought about by the fact that the "pooling" arrangement between the City Council and the Electricity Supply Commission of South Africa, comes to an end in May 1957 and that the Commission had already intimated that no other type of "pooling" agreement would be considered.

To provide for future requirements the City Council was therefore faced with the position of either itself operating a new station or taking a bulk supply from the Commission. Wishing to retain its independence in the generation of electricity, the Council agreed in principle to the building of a further power station and the city electrical engineer, Mr C. G. Downie, suggested land owned by the municipality close to the Council's Athlone sewage disposal works, as being a suitable site. The question of a site on the sea front near Cape Town, which would enable direct cooling to be adopted, had to be ruled out as it was found that no suitable site was available. Merz and McLellan were appointed consulting engineers and have now been authorised to proceed with the preparation of the necessary detail drawings and specifications for the first section of the scheme.

Ultimate capacity of the new station will be six 30 MW turbo-alternators and eight boilers, seven of which will be capable of steaming all the sets at full load. At present-day costs, the complete scheme is estimated at £14 millions and it is anticipated that it will be finally completed by about 1965. The first stage will comprise two turbo-alternators designed for steaming at 600 lb/sq in. and 900° F, and three 260 klb/hr boilers. The estimated cost of this section with the buildings and ancillary plant is £6,154,000. An additional 10% is being provided to cover possible price increases.

Owing to difficulty in disposing of fine ash it is not intended to adopt pulverised fuel firing, but instead to seek alternative prices for boilers with chain grate stokers or with spreader type stokers. Incidentally, it is estimated that a saving of £180,000 on the complete station could be secured by adopting semi-outdoor construction instead of the conventional boiler house. Coal off-loading facilities will be by wagon tipper, one of which will be installed at the first stage. Each of the cooling towers will be designed to re-cool the circulating water from two 30 MW machines, effluent from the sewage works being utilised for cooling purposes. As the station is expected to expand rapidly it is proposed for reasons of economy to complete with the first stage a good deal of work to serve subsequent extensions. The first stage main buildings will provide for 3 sets and 4 boilers.

The provision of the new station is a matter of urgency for, according to Mr Downie, the rate of growth of load in the Cape is such that additional generating plant will have to be in service by the winter of 1960, by which year, it is estimated that the existing generating plant, together with that on order for Escom's Salt River No 2 power station, will no longer be able to meet the combined demands of the Council's and the Commission's consumers. It is thought to be possible to meet this eventuality if contracts for the main items of plant are placed by April-May next and steps to this end are being taken.

Personalities

IN THE INDUSTRY

Head of the Lighting Equipment Engineering Department of the British Thomson-Houston Co., Ltd., since 1950, **Mr F. Widnall,** B.SC., M.I.E.E., has been appointed manager of the company's lighting fittings factory at Hereford. After serving an engineering apprenticeship with B.T.H., Mr Widnall spent nine years in the Research Laboratory before joining lighting equipment engineers in 1939. He is a member of the Illuminating Engineering Society and of the Association of Mining Electrical and Mechanical Engineers.

Mr L. Holland and **Mr F. G. Rowland,** M.I.E.E., who for some years have been associated with the company, have been appointed directors of Switchgear & Cowans Ltd. **Mr Douglass Hewitt** has been appointed an additional director.

Mr R. Drinkwater has been appointed by the Brush Electrical Engineering Co., Ltd. to be turbine specialist engineer in succession to **Mr R. D. Taylor,** recently appointed London branch manager. Mr Drinkwater has worked for the C.E.A. on power station layout and with the English Electric Co., Ltd. and with W. H. Allen, Sons and Co. on turbine development.

Mr P. J. C. Bovill, an assistant managing director of Newton Chambers and Co., has accepted an invitation to join the board of the Wellman Smith Owen Engineering Corporation Ltd.

The Metropolitan-Vickers Electrical Co., Ltd., announces that **Mr J. N. M. Legate,** B.SC., A.M.I.E.E., has been appointed assistant chief engineer, Industrial Control Department. Mr Legate received his technical education at the Imperial College of Science and Technology, City and Guilds (Engineering) College, and after taking his B.Sc. at London University he went to Metropolitan-Vickers as a college apprentice in 1931. On completing his course he joined the Industrial Control Sales Department as a junior engineer. Since 1947 Mr Legate has specialised in electronic control, and for the last two years he has been assisting the sales manager of the Industrial Control Department.

Among the Ministerial changes in the Government announced last week, there is a new Minister of Fuel and Power. He is **Mr Aubrey Jones,** who succeeds **Mr Geoffrey Lloyd** who has filled the post with some distinction for over four years. Mr Jones, 44 years of age, who has been promoted from the back benches, has been economic director of the British Iron and Steel Federation since 1954, and has been a prominent member of the Conservative Fuel and Power Committee which has been for some time critical of the former Minister, Mr Geoffrey Lloyd. The son of a Welsh steelworker, he was educated at Merthyr Tydfil Secondary School and the London School of Economics. A new Parliamentary Secretary to the Ministry of Fuel and Power has also been appointed. He is **Mr David L.-M. Renton,** Q.C., who succeeds **Mr L. W. Joynson-Hicks.**

Mr Aubrey Jones

Dr G. J. Szasz

Mr J. R. Cheetham

Mr G. A. L. Robinson, whose appointment to the board of directors of T. Clarke and Co., Ltd. we briefly noted last week, joined the firm in 1932 and is a well known figure in the contracting industry. His father, the late Mr G. H. Robinson, was a director and later managing director of the firm.

The General Electric Research Laboratory, U.S.A., has established a European office in order to strengthen its contacts with basic research activities being conducted in Europe. Appointed as the first scientific representative at the European office is **Dr George J. Szasz,** whose duties will include attending scientific meetings and visiting laboratories which conduct fundamental research in scientific areas of interest to the G.E. From 1948 until his recent resignation to accept the G.E. post, Dr Szasz was with the London branch of the U.S. Office of Naval Research, and for the past year he had served as the branch's deputy scientific director. A native of Budapest, Hungary, he studied at the University of Budapest before going to the United States in 1938. He received his master of science degree from the University of Cincinnati in 1940 and his Ph.D. in physical chemistry from Pennsylvania State University in 1947. For the present, Dr Szasz will maintain an office with the International General Electric Ltd., Crown House, Aldwych, London, W.C.2.

Mr F. Widnall

Mr J. N. M. Legate

Mr G. A. L. Robinson

Export manager to Edison Swan Electric Co., Ltd., for 25 years, **Mr J. R. Cheetham** retires on 31 Dec. Born in 1883 at Stockport, he received his education in electrical matters at the Municipal School of Technology, Manchester, and in 1898 took up a position with a Manchester firm of electrical engineers and contractors, following this by 3 years with a Manchester firm of wholesalers. For nine years prior to 1919 he held various progressive positions with the British Westinghouse Electrical Manufacturing Co., Ltd., and the Metropolitan Vickers Electrical Co., Ltd., Manchester.

Mr G. Ezard

Sir Norman Duke

Mr W. Hutton

Mr R. Lott

for the greater part of the time being engaged in export interests. When the Metropolitan - Vickers Electrical Export Co., Ltd., was formed in 1919 Mr Cheetham became manager of the Supply Section and in this capacity he visited various Continental countries. On the formation of Metropolitan Vickers Supplies Ltd., he also became manager of the Accessories Department, covering Home Counties and export on sales development and organisation. In June 1930 he was appointed Accessories Department Manager and export manager of the Edison Swan Electric Co., Ltd., holding the latter position until his retirement.

At the 2nd annual dinner of the Ediswan (London and District office) Long Service Association, held recently, the chairman was **Mr D. F. Botwright** (Publicity Department) who has been re-elected to the chair for 1956. Our accompanying illustration shows, left to right: **Mr F. E. C. Miller** (vice-president), **Mr H. Butterworth** (president), **Mr A. H. Adey** (Birmingham district office manager), **Mr D. F. Botwright** (chairman) **Mr V. J. Bainbridge** (Committee), **Mr J. W. Ridgeway** (vice-president). At the dinner, long service awards were presented by the president of the Association, Mr H. Butterworth (managing director), to four members, **Miss Whitwell** (Leicester), **Mr A. G. N. Dixey** (company secretary), **Mr C. W. Harvey** (Cardiff) and **Mr E. S. Speller** (London).

At the Ediswan Long Service Association dinner

Sir George Thomson and **Sir Hugh Warren** have accepted invitations to become members of the technical committee of the International Tin Research Council.

Sir Victor Tait has been appointed to the Board of Ultra Electric (Holdings) as an additional director.

Vice-president of Fishbach and Moore, Inc., one of the largest electrical contracting concerns in the U.S.A., **Mr Harry C. MacNary** is making a special visit to Britain to lecture to members of the Association of Supervising Electrical Engineers at the Royal Institution, London, W.1, on 17 Jan. next. He will be speaking on Electrical Installations in American Multi-Storey Buildings, a subject of which he has wide knowledge, for he supervised the electrical work for the United Nations Organisation's skyscraper headquarters in New York, in addition to various other notable installations.

At present engineer to the Suffolk subarea of the Eastern Electricity Board, **Mr G. Ezard,** M.I.E.E., has been appointed to the Technical Section of the Chief Engineer's Department at the Board's headquarters at Wherstead, Ipswich, for specialist work concerned with certain aspects of standardisation and forward technical development. He takes up his new duties on 2 Jan.

New appointments to the South of Scotland Electricity Board are announced as a result of the resignation from the deputy-chairmanship of **Sir Norman Duke,** K.B.E., C.B., D.S.O., M.C., who is to retire on 31 Jan. The Secretary of State for Scotland has appointed in his place **Mr William Hutton,** M.A., LL.B., COMP.I.E.E., who has been a full-time member of the Board. **Mr Ian Macdonald,** general manager of the Commercial Bank of Scotland, and **Mr Robert Hunter,** Provost of Musselburgh, have been made part-time members of the Board, with effect from 1 Feb. next. Sir Norman Duke has been deputy chairman of the South of Scotland Electricity Board since it was established in Dec., 1954, and was previously chairman of the South East Scotland Electricity Board since its formation. He entered the Scottish Office in 1919, becoming secretary of the Scottish Home Department in 1939. During the last war, Sir Norman was successively principal officer to the Regional Commissioners for Scotland, additional deputy Under-Secretary of State at the Air Ministry, and joint deputy secretary at the Ministry of Fuel and Power in charge of petroleum. He resumed duty as secretary of the Scottish Home Department in 1946. Mr Hutton, who has been a full time member of the South of Scotland Board since Dec., 1954, was previously deputy chairman of the South West Scotland Electricity Board from 1948. Earlier he was senior deputy town clerk for Edinburgh for nine years after three years as town clerk at Kirkcaldy.

Mr F. G. Wilmot, who was recently appointed director and secretary of Orkley Brothers Ltd., a subsidiary company of W. T. Henley's Telegraph Works Co., Ltd., is also assistant secretary of the latter concern.

The new station superintendent at Portobello power station, South of Scotland Electricity Board, is to be **Mr R. Lott,** A.M.I.E.E., A.M.INST.F., who, since Nov. 1954, has been deputy superintendent at Dunston "A" and "B" and Blaydon power stations, North Eastern Division, C.E.A. Prior to taking up the latter position, Mr Lott was with the South East Scotland Division for six years, latterly as senior assistant engineer. He served a general engineering apprenticeship with the South Wales Electric Power Co. between 1937 and 1941, following which he became junior boilerhouse engineer at Upper Boat power station. Later he was transferred to Llynfi power station as assistant combustion and efficiency engineer, and was subsequently promoted to combustion and efficiency engineer. He then joined the S.E. Scotland Division in 1948 as second assistant engineer, generation (operation). In his new post, which he takes up on 1 Feb., Mr Lott will succeed **Mr M. P. Henzell,** M.I.E.E., ASSOC.I.MECH.E., M.INST.F., M.INST.W., who has been promoted to operation and maintenance engineer (generation) to the South of Scotland Board.

OBITUARY

Mr H. E. Ferguson, formerly general manager of the Clyde Valley Electrical Power Co., Ltd., died on 19 Dec.

Mr F. J. Toone, O.B.E., managing director of Parneko Ltd., has died aged 47.

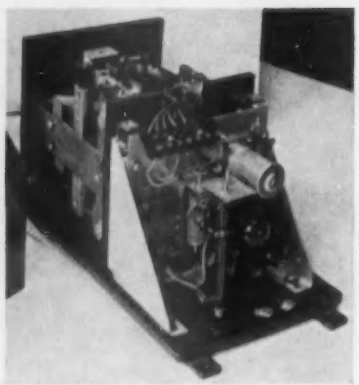
Mr A. S. Carr, M.A., M.I.E.E., who died on 15 Dec., aged 66, served with the Engineering Department of the G.P.O. for many years, initially in London and Eastern Districts, and later in North West England, where he was executive engineer responsible for the construction of G.P.O. engineering plant in Lancashire.

Equipment for Industry

Welding in Safety

RECENTLY, a safety relay has been introduced to reduce the hazard of severe shock to welding operatives employing high voltage equipment. This unit, designed by PHILIPS ELECTRICAL LTD., Shaftesbury Ave., W.C.2, functions as a voltage divider, reducing the full open circuit voltage of the power source by 50% between operations and only permitting maximum output when the welding arc is ignited or burning. Although this system does not remove the possibility of the operator receiving a shock, it can minimise the extent of an accident which may otherwise be serious.

The relay, PE.3100, contains a splitter arrangement which the output supply automatically by-passes when the electrode makes contact with the workpiece, in this way the maximum voltage becomes available to strike an arc between the metal requiring welding and the electrode. To allow rapid re-striking should the arc break, an incorporated delay mechanism maintains peak supply voltage for 1 second after the arc ceases. Measuring only 14 in. by 7 in. by 7 in., the relay may be installed in the output stage of almost any welding plant, a.c. or d.c. up to a capacity of 500 A, but with the reservation that when used in conjunction with multi-operator equipment, individual relays must be fitted between each regulator and respective electrode holder.



The interior of Philips' new welding safety relay PE.3100 which incorporates a voltage divider arrangement to reduce by half the full open circuit voltage of the power source

New Goggles accommodate Spectacles

WHILST there is a wide range of protective goggles for operatives with good eyesight, there are few models specifically designed to be worn over spectacles. To meet the needs of those workers requiring both eye protection and correction at the same time, E. ELLIOTT LTD., 315 Summer Lane, Birmingham, manufacturers of Birmite and Birflex industrial goggles, have introduced the new Birflex Major range. These goggles will accommodate practically any type of spectacles with the advantages of the two previous models. The frames, of pliable polythene, moulded to the contours of the face, are sufficiently flexible to ensure a close fit without discomfort. Ample ventilation and the elimination of condensation have been assured by the provision of suitable grids so placed to prevent draughts. The windows have been designed to give maximum protection and unimpaired vision, and may be quickly replaced on becoming scratched or damaged. Available with green tinted windows and opaque green frame for gas welding without flux, the goggles are suitable for most industrial purposes including grinding.

Versatile Thermo-plastic Adhesive

A NEW adhesive has been made generally available after undergoing development and tests in the research laboratories of a well-known rubber manufacturer. The compound has been claimed to bond practically any material to another, providing the surfaces are clean and dry, with a high resistance to water, weak acids and weak alkalies. As a thermoplastic, this adhesive known as Pliobond, manufactured by GOODYEAR TYRE AND RUBBER CO (G.B.), LTD., Wolverhampton, softens at elevated temperatures with some reduction in bond strength. However, ageing or prolonged exposure to high temperatures is said to improve the bond resistance to heat.

The application of Pliobond usually resolves itself into one of three methods, the choice depending on the expected factors of materials to be joined, bond strength required and equipment available. In general, the strength of the bond obtained with heat and pressure is superior to that obtained under room temperature conditions. The most satisfactory technique is hot or dry bonding where the two surfaces are preferably non-porous and able to be heated to some 300° F with continuous pressure being applied. Reactivation bonding lends itself to joining porous surfaces, here the surface of the more dense component is reactivated by wiping with a cloth saturated with solvent after the applied adhesive has dried, again pressure on the bond becomes desirable if not essential. Finally, cold or wet bonding should be used for extremely porous surfaces.

Robust Miniature Switches

ALTHOUGH primarily designed for use in aircraft, the range of miniature push-button and pressure switches developed by the aviation division of DUNLOP RUBBER CO., LTD., Foleshill, Coventry, may prove useful to industrial equipment requiring components of maximum reliability. Both types of switch have been designed and rigorously tested to meet Ministry of Supply specifications. Rated at 2 A and 0·5 A respectively for non-inductive and inductive circuits, the push-button switch has silver contacts for minimum resistance and a claimed life of at least 100,000 make and break operations either at sea level or an altitude of 60,000 ft.

Approximately the diameter of a penny, the second switch, pressure operated, breaks at 60 p.s.i. and makes at 40 p.s.i., other switches contained in this range are suitable for use in systems working at pressures up to 4,000 p.s.i. and maximum non-inductive currents of 10 A. These switches are said to possess a minimum life of 100,000 operations and have been tested under severe conditions, vigorous vibration and fluctuating pressures to produce arcing at the switch contacts. On the basis of these mechanical and electrical tests, the manufacturers claim that contact resistance showed little change.

Primarily designed for aircraft use, these miniature push-button switches, developed by Dunlop are rated at 2 A

Car Engines for Industry

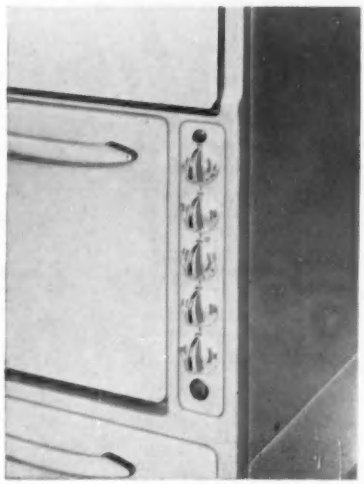
TWO companies, both well-known in their respective industries, have merged to produce a new range of industrial i.c. engine generating plant. With the name of "STAD" derived from STANDARD MOTOR CO., LTD., Coventry, and AUTO DIESELS LTD., Uxbridge, the engines are those fitted to Standard cars and Ferguson tractors but adapted for industrial purposes by Auto Diesels. At present a total of five power units are available, ranging from a 948 c.c. petrol engine to a 2·1 litre diesel although adaptions also may be made for paraffin and natural gas consumption. One of the main advantages, apart from the high quality and low cost, that may be gained from employing these new "Stad" generators, is the availability of spares and service facilities offered by the two large scale manufacturers who have introduced this useful industrial engine range.

B.N.E. Cooker control unit and C90 cooker modifications

AS reported in our issue of last week (see p. 971) the marketing of the Metalform cooker time control unit has been taken over by BRITISH NATIONAL ELECTRICS LTD., Newarthill, Motherwell.

At the same time modifications to B.N.E. C.90 cooker were announced and we are now able to illustrate the two new introductions.

The "metalform" cooker timer is now marketed by B.N.E.



Larger switch controls are fitted to C90 cookers

Glass Tubular heating system

LOW temperature tubular heating using runs of toughened glass tubing fixed to the skirting boards of rooms is at present being manufactured and marketed by A. AND R. ELECTRIC CO., LTD., 1 Bruce Ave, Shepperton, Middx.

A loosely coiled resistance wire element is contained in the glass tubing. The heating system is supplied and installed in the London area at 12s. 6d. per foot and a thermostat can be provided at 50s. extra. Rating of the tube is 50 W per ft.

Price Increases

AN announcement from BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2, gives details of the purchase tax increase on fluorescent industrial and commercial lighting fittings. The notice states that as a result of the Budget purchase tax increases it is necessary to revise the purchase tax percentages as follows: Where purchase tax was previously 18¼% of list price it is now 22%, where purchase tax was 16¼% of list price it is now 19½%.

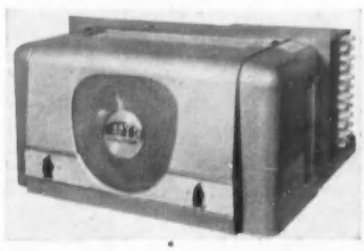
Air Conditioning by Westool

NEW introductions by WESTOOL LTD., St. Helen's, Auckland, Co. Durham, are of particular interest to heating and ventilating engineers.

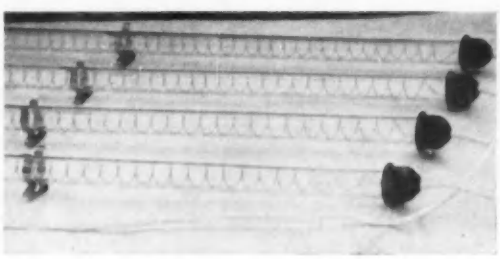
First new item is the "Westair" Climatiser—an air conditioning unit in five models and the second is the "Westair" Dehumidifier. The function of the "Climatiser" is to cool the air at the same time truly conditioning it by filtering out dirt, dust and pollen, reducing humidity and introducing clean fresh air. As "air to air" units the climatisers should be fitted into windows or wall apertures having external walls. Principle of operation is as follows. Room air is circulated through the evaporator unit by the evaporator fan which takes the air in through the top grill through a filter and a cooling coil (coupled to a hermetically sealed refrigeration unit) and then blows it back into the room. The heat extracted from the air is pumped away by the compressor and rejected ouside via the condenser through which another fan circulates outside air. The moisture extracted from the room air runs into the base tray of the unit from whence it is atomised by fan into the outside air. To achieve maximum cooling effect, room air is recirculated but outside air can be admixed at will in controllable proportions. All units are supplied with accessories for fitting in window or wall openings and are available in five shades of polychromatic stove enamel. The five models differ in capacity and usage i.e. ½ ton "Standard" model for high temperature tropical condition, ½ ton "Home" type suitable for moderate climate where outside temperatures do not exceed 100° F, ½ ton "Tropical" model a simplified version without provision for extraction or ventilation; ½ ton "Continental" model for use with or without heater with or without thermostatic heating and cooling control and the 1 ton "Duplex" model embodying two independently switched ½ ton units. The ½ and 1 ton ratings refer not to the weight of the unit but to its cooling effect, i.e. half a ton of refrigeration—the cooling effect of half a ton of ice in 24 hours (6,000 B.Th.U.).

The Westair Dehumidifier, also illustrated, has no cooling action. Air is taken through the louvred inlet through a sealed refrigeration system and out via another louvre. The moisture extraction rate varies with different conditions and may reach a maximum of a pint per hour. It will work continuously in ambient temperatures up to 110° F.

For the Electrical Trade



Above, The Westool Climatiser is designed to bring the coolness of an English summer morning to tropical residencies. Their new humidifier on the right gets rid of 1 pint of moisture per hour



On the left is an illustration of the A and R glass heating tubes

PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Dusty Motor

BAD starting and uneven running were the symptoms described in connection with a 50 h.p. screen protected type slip-ring motor bought as "completely reconditioned and as new" and installed at a local corn millers. A cursory examination at once indicated that the motor was badly choked up with meal and on dismantling it was found the ventilating channels were made up and the spaces between the rotor clips and under the banding had become choked.

There was on the stator winding a telltale deposit of solder which had been thrown from the rotor bands and clips and indeed many of the rotor clip joints were dry and loose. The overheating which had taken place was not due to any inherent defect in the motor but was entirely due to the motor being of a type unsuitable for the extremely dusty site conditions.—*"Torque."*

Neither Were Wrong

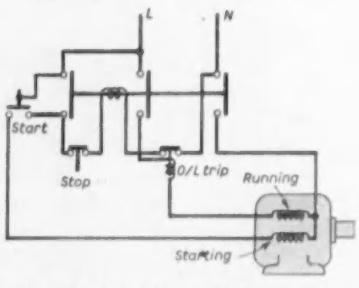
A RECENT emergency telephone call resulted in my having to tackle a rather interesting problem at a nearby mill. The story presented to me was that the mill had been changed over to electric drive on the group principle, being split into six sections, and that a number of new machines had also been installed. When ordering this equipment, statements of horsepower involved had also been obtained to enable these figures to be given for the electrical work. Eventually two orders were placed, one for the supply and fixing of the new machines and the other for all the motors and lighting, and their installation.

All the work was supposed to have been finished three months' earlier, but from the mill manager's point of view, nothing satisfactory had so far been attained since the mill's output had fallen considerably. Both firms concerned were blaming the other, the machine makers insisting that their equipment required the power originally stated and that the motors installed were not giving it, whilst the electrical contractor maintained that his motors and cabling were satisfactory and that the machines were requiring far more power than that stated.

A day-time tour of the works showed that the lighting, where in use, was not giving anywhere near an impressive brightness and hence suspicion centred on the supply. A test at the main switch showed an incoming pressure of 290 V between phases—on a 400 V supply. A call for the local supply engineer was then indicated and my suspicions were confirmed by finding out that the mill was connected to the end of an l.t. network not large enough for the new load. In fact, the local engineer was only too well aware of the trouble but hoping to postpone the day when he would have to spend a considerable amount of money in laying an h.v. main to a transformer substation on the mill site. The proper supply was not long in coming, and the new machinery then gave its rated output, proof, if it were needed, that the respective claims made by the two firms concerned were correct after all.—*"Harmo."*

F.H.P. Starting Switch

TROUBLE is often experienced with small single-phase capacitor and split-phase type motors due to faulty operation of the internal centrifugally operated switch for cutting out the starting winding or capacitor when the motor has run up to speed. Such motors are, of course, largely used by non-technical operatives and proper maintenance, which necessitates dismantling the motor, is consequently often neglected. A common fault resulting from lack of maintenance is the sticking of the centrifugal switch in the "running" position, with consequent stalling of the motor when next switched on, and as the non-technical operator is liable to switch the current on repeatedly in an effort to get the motor to start, there is a real danger of overheating and ultimate burn-out of the winding.



Control circuit for a single-phase motor replacing the centrifugal switch

This trouble could be eliminated, the working life of these motors appreciably extended and reliability increased if the centrifugally operated switch were replaced by a simple device requiring no maintenance. The same purpose could be achieved by the use of a manually-operated push-button switch connected as shown in the accompanying diagram. Closure of the switch puts the starting winding in circuit and when the motor has run up to speed, the release of the switch-push disconnects the starting winding.—*S. Spence.*

Protective Pushbuttons

THE humble push-button switch can often be pressed into service to carry some unusual function, as shown by two recent experiences. The first concerned two transformers, of 600 kVA and 800 kVA and used to step down a works supply from 11 kV to 400 V. The push buttons were employed to supplement the protective system which, of some antiquity, employed gear which could not be set to give close protection against overload. If either the primary or secondary oil switches of the smaller transformer tripped out, there was a risk that the 800 kVA transformer might remain overloaded to 25% by carrying the total works load of about 1,000 kVA. The risk was eliminated by fitting a push button on each of the smaller transformer's two switches, arranged in a bell circuit so that an alarm was rung when either switch opened.

A somewhat similar arrangement was fitted to several motors which drove shafting for textile machines through rope drives. A specially made iron bracket, fitted with a push button was mounted close to the rope pulley of the motor. The push-button contacts, connected in series with the n.v. coil of the motor, were normally held closed by a light wooden stick, pointed at both ends and resting between a recess in the bracket and the recessed push-button. Were one of the ropes to break, it struck the stick out, released the push button, and open-circuited the n.v. circuit.

Although somewhat "Heath Robinson" in character, this device was so effective that it later was applied, in principle, to protect the operator of a motor driven saw. In this case, the rear edge of the saw, when cutting thin wood, sometimes caught and threw the wood upwards. A similar bracket arrangement, fitted above the saw tripped out the motor.—*W. J.*

Repairing Elements

THE usual method of effecting a temporary repair to the spiral element of an electric fire, is to ascertain the place of fracture and re-unite the broken wire ends by twisting them together. This "junction" soon develops into a "hot spot," finally breaking down in a shower of sparks. An arrangement which I have used many times to carry over until a replacement could be obtained, is to twist in with the "junction" a short piece of 22 s.w.g. copper wire. It will be found that the "join" runs much cooler, giving more time for replacement.—*G. W. Clegg.*

NEWS OF THE WEEK

Electronics and Productivity

EXHIBITION AND CONFERENCE IN GLASGOW NEXT FEBRUARY

AS PREVIOUSLY reported in these columns the S. of Scotland Electricity Board is organising an Electronics and Productivity Exhibition and Conference at the Kelvin Hall, Glasgow, between 6 and 9 Feb. Details of the event were issued last week. This will be the first event of its kind to be staged in Scotland, and the Electricity Board is arranging a comprehensive and up-to-date review of electronic devices. About 60 manufacturers of electronic equipment will be exhibiting, as well as the E.R.A., the E.D.A., Glasgow and Edinburgh Universities, the British Productivity Council, and of course the Board themselves, who will have a lounge and advice bureau. At the conference, lectures will be given by experts, who will stress particularly the practical advantages of using electronic apparatus and illustrate the financial savings which electronics are making in industrial processes. Throughout the exhibition a selection of appropriate films will be shown. Times of opening are 10 a.m. to 5 p.m. on Monday and Thursday and 10 a.m. to 9 p.m. on Tuesday and Friday. Admission will be free but by invitation card only. The exhibition is of a specialised nature and primarily intended to attract industrialists and engineers, but the public can also obtain invitations.

The conference programme contains no fewer than nine lectures, with three on the first day and two each on the remaining three days. Mr R. McGlashen of the Board opens proceedings with a general talk on Electronics and Productivity. In the afternoon there are two lectures: Aqueous Solutions in Industry by Mr R. S. Evans of Pye Ltd., and Applications of Nuclear Isotope Devices to Simplify Production, by Mr S. B. Knowlden of Isotope Developments Ltd. Tuesday's lectures are on Electronics and High Productivity in the Heating and Joining of Metals, Wood and Plastics, by Mr F. L. Gladwin of Wild-Barfield Electric Furnaces Ltd., who will deal with Metals, and by Mr O'C. Horgan of the General Electric Co., Ltd., who will cope with Wood and Plastics. The boosting of production by the use of electronic devices will form the subject of Wednesday's lectures, Mr R. J. F. Howard of Lancashire Dynamo speaking on the control of machinery, and Mr J. E. Fielden of Fielden Electronics Ltd., on the control of industrial processes. Mr G. S. Kermach of Ferranti Ltd. will speak on Batch Manufacture of Precision Components by Computer-Controlled Machine Tools, on the final morning. The last talk in the programme will be on the Electronic Computer as an Aid to Designing and Production Planning, and will be given by Mr O. B. Chedzoy of English Electric.

International Essay Contest on Productivity

IN ORDER to encourage people to look for and study methods of increasing productivity, the British Productivity Council is co-operating with the European Productivity Agency in promoting an International Productivity Essay Prize Competition. Five prizes, comprising a visit to Paris and a 10-day tour of at least one European country, will be awarded in each participating country. The competition is limited to students who are attending a course of study in industrial or technical subjects. Essays, which must not exceed 4,000 words, should describe how a significant increase in productivity has been achieved in some specific plant, firm or organisation through the introduction of new methods or use of special techniques. Every essay submitted must be accompanied by an official entry form, which may be had from the B.P.C. at 21 Tothill St, London, S.W.1, up to 6 Feb. Entries must reach that address by 7 Mar.

Thorn's TV Rental Plan

THE renting of television sets has become more popular in recent months, and because of this trend, and the expansion of companies offering rental and relay facilities, Thorn Electrical Industries Ltd. have decided to step up their own interest in the rental business. Many Ferguson dealers already obtain financial assistance from Thorns in conducting such business, but it is now intended to increase that assistance. Thorn have a direct share in the rental business through a controlling interest in Domestic Electric Rentals. Main aim, we understand, is to maintain a steady flow in production of TV chassis.

TRACTION COMPANY CHANGES ITS NAME

IT HAS been announced by the Brush Group Ltd. that as a matter of policy the name of Brush Bagnall Traction Ltd. will be changed to Brush Traction Ltd. The step has been taken with the approval of the Board of Heenan Group Ltd. The statement adds that Brush Bagnall Traction Ltd. had always been a wholly-owned subsidiary of the Brush Group Ltd. but very friendly relations have always been, and still are, maintained with W. G. Bagnall Ltd., a wholly-owned subsidiary of Heenan Group Ltd. Mr W. A. Smyth and Mr E. W. Marten, directors of W. G. Bagnall Ltd., retire from the Board of Brush Traction Ltd., in view of the change of name, and Mr J. Calderwood retires from the Board of W. G. Bagnall Ltd.

Ecuador's $1m Radio Contract placed in U.K.

A CONTRACT worth over $1m in Ecuador's ambitious multi-channel radio telephone/telegraph system has been placed with Marconi's Wireless Telegraph Co., Ltd. The British company faced keen competition from France, Germany and the U.S., and the success is the more notable because it has been achieved in the important Latin-American market. The contract involves the supply of radio, carrier-telephone, voice frequency telegraph and teleprinter equipment, as well as power plant, towers and aerials. The proposed system will link a number of Ecuador's important cities and towns, covering a total distance of over 265 miles.

Cambridge-Texas Link

A NEW tie up between U.K. and American firms was announced recently. Pye of Cambridge and Electra-Technical Labs. Inc., of Houston, Texas, have jointly formed a new company called Seismic Instruments Limited.

Courses arranged at Liverpool University

DETAILS of postgraduate courses in science to be held in the spring term at the University of Liverpool have been forwarded to us. One is a course of six lectures by Dr R. J. Wasilewski on X-ray Metallography. It will be given on successive Tuesday evenings beginning on 17 Jan. A second will be on Electronic Analogue Computers and will comprise a series of five lectures on Thursday evenings from 19 Jan. Lecturer will be Mr A. S. Aldred, lecturer in electric power engineering at the University. Fee for each course is £1. 1s.

We note too that the University is running three five-day Easter Vacation courses. They will be on Numerical Analysis, Fundamental Processes of Gaseous Discharges, and Basic Principles of Nuclear Engineering.

This display of Dimplex Ltd. radiators is currently touring railway station showcases of Messrs Baxendales on Merseyside. The particular showcase illustrated is at Central Station, Manchester. Centrepiece is Perspex display model

Keener Competition among MANWEB Displays

RESULTS of the annual Christmas window display competition organised for their service centres by the Merseyside and N. Wales Electricity Board were announced just before the holiday. Outstanding among the final choices was the success of the Knutsford showrooms who carried off the Rankin trophy for the second year in succession. This trophy was introduced to the competition in 1953 and is held by the winner in the class for small showrooms. The Oliver trophy for medium sized showrooms, introduced in 1951, was won this year by Widnes. The original trophy, now competed for by the large showrooms, the Eccles Shield, was won this year by Chester. The competition has been held each year since 1949.

The judges found this year that competition for the prizes was unexceptionally keen. Usually there is a unanimous decision among the judges in respect of one outstanding display, but this year the trophies were won by majority decisions. Preliminary judging took place in each of the Board's sub-areas, the best in each class being submitted for the finals. Once again, both the exteriors and interiors of the showrooms were considered, but unlike previous contests there was no theme.

Maldon Again Win First Place Among EEB Showrooms

SHOWROOM staff at Maldon (Essex) have good reason to feel proud of themselves. In the results of the Eastern Electricity Board's Christmas Service Centre Competition, the showroom won first prize among medium sized service centres, thus repeating their success last year when they tied for first place with Leighton Buzzard. It is of note too that Maldon gained a similar distinction in 1951, when the competition was divided into two classes only. Since then there have been three categories, and this year Peterborough won the trophy among large showrooms, and West Mersea among the small service centres. Once again the standard of display and efficiency rose considerably. This competition may be one of the most exacting, for the window display and interior presentations of goods are only one aspect. The judges also take into account such items as the neatness of price tags and the deportment of assistants. Prizes were also awarded to the best displays in each of the six sub-areas. These were awarded to Luton, Leighton Buzzard and Oxhey (Chilterns); Wickford and Epping (Essex); Wisbech and Soham (Fens); Norwich, Cromer and Wymondham (Norfolk); Crouch End, N. Chingford and E. Barnet (Northmet); and Ipswich and Beccles (Suffolk).

Loco Repair Shops

A SCHEME for improved cranage and locomotive repair facilities has been completed by the Scottish Region of British Railways at their Inverurie works. Among the alterations was the installation of a new 100-ton seven-motor electric overhead twin crab travelling crane. There is also a new 40-ton, seven-motor crane, and existing electric welding facilities have been concentrated in one workshop.

New B.B.C. Studios

OFFICES are to be built on the vacant site adjoining Broadcasting House in Portland Place, London, and on completion the B.B.C. will take a long-term lease and occupy the whole building. Most of the building will be used as administrative offices, but in the basement, the B.B.C. is to construct two drama-suites, four talks studios and recording rooms, and two discussion studios for sound broadcasting. Areas on the ground and first floors will be left for a new main control room and accommodation for other technical facilities. The office building will be erected by the Prudential Assurance Co., Ltd.

House Organ's Christmas Debut

A NEW quarterly magazine, designed to interest all employees both at home and overseas, has been launched by Automatic Telephone and Electric Co., Ltd. The mag is called *Tone* and comprises 32 pages of company news printed on art paper and enclosed in a four-colour cover. Other publications provide the technical interest. Free copies of the new journal were despatched to all the company's pensioners in time for Christmas.

S.E.B. Showrooms Opened

THE Southern Electricity Board opened new showrooms in Normandy St, Alton, recently. Opening ceremony was performed by Clr W. H. Shipley, chairman of the local council.

Seasonal Greetings Gratefully Acknowledged

WE have been the fortunate recipients, once again this year, of many attractive calendars bearing the seasonal good wishes of our friends in the electrical industry. It gives us equal pleasure in acknowledging them and heartily reciprocating all the greetings and kind thoughts expressed.

The illustrations which enhance many of the calendars seem to become more appealing as the years pass. One of the most outstanding this year (if one dares to compare) is that of Brown Boveri and Co., Ltd., with twelve colourful pictures of Swiss scenery. Maintaining the high standard set in previous years of views of the British countryside is the calendar of C. A. Parsons and Co., Ltd. In fact, of course, the majority of firms retain a theme. Chloride Batteries Ltd. always produce a colourful array of pictures and this year they concentrate on really attractive floral paintings. A Derbyshire view always supports D. P. Battery and Co.'s calendar, their latest choice being the River Wye at Bakewell. A single picture suffices on Courtney Pope (Electrical) Ltd.'s production, and shows an unusual view of the city of Durham. Twelve scenes in their own works are featured by Fischer Bearings Co., Ltd., and the Edison Swan Electric Co., Ltd., have a tablet type calendar with a daily motto or saying. Fraser and Chalmers Engineering Works have a picture of a lovely young lady beside the calendar itself and a small coloured scenic picture for each month. Stewarts and Lloyds retain their plain white desk calendar with the month in a protected "window."

Other calendars have been received from the Lindley Thompson Transformer and Service Co., Ltd., Permali Ltd., G. S. Peckham and Co., Ltd., Colton Electrical Equipment Co., Ltd., and Monsanto Chemicals Ltd.

The First Half-Century

The electric radiator is an excellent thing in its way; but its very virtues put it out of harmony with the Christmas spirit, and not even the side table, with "the walnuts and the wine," gives the true Christmas atmosphere.

Heap on more wood! the wind is chill!
But let it whistle as it will,
We'll keep our Christmas merry still.

That is the true Christmas note. Still it were better to break with tradition altogether and gather round the steady cheerful glow of the electric radiator than put up with that miserable half measure, the gas fire. The one advantage of the gas fire is that it is easily lighted, but its boasted economy disappears up the chimney unless it be stuffy malodorous gas radiator.—*From our issue* 28 *Dec.*, 1905.

Parks Commission suggest Early Tripartite Talks

ONCE again, electricity supplies, and the siting of overhead lines in particular, form a large section of the annual report of the National Parks Commission. This is the Commission's sixth report and covers the year ended 30 Sept. In the course of the year nearly 1,500 proposals by Electricity Boards were considered and in most cases were passed because "the damage to amenity was not likely to be such as to merit our disapproval." In some cases modifications were sought, and in a few, notably in respect of the Lake District's Borrowdale and Patterdale schemes, and the Merrivale and Meavy schemes on Dartmoor, the Commission objected strongly.

The report also stresses the Commission's obligations in drawing Minister's attentions to the claims of amenity and the maintenance of natural beauty. Acknowledgment of the Board's willingness to make concessions is recorded again. They point out, however, that in some cases Planning Authorities have given way to contrary arguments against their better judgment. They deprecate this practice and emphasise that the claims of amenity should be forwarded to the Minister whose duty it was to weigh the rival considerations of amenity and cost. At a meeting with the C.E.A., the Commission stressed the value of early consultation on new projects, and suggested that preliminary tripartite discussions between the Boards, Planning Authorities and themselves should become standard practice. The C.E.A. undertook to explore this suggestion.

Particular cases in which the Commission were involved are mentioned, with special reference to the Borrowdale and Patterdale schemes and the N. Wales Hydro-Electric Power Proposals.

Rubber Development

A £5½m development programme for producing natural rubber from their Malayan plantations has been announced by Dunlop. The announcement states that the last tree was expected to be in position by 1961 when over 72,000 acres would be in production. Of this year's total rubber consumption, some 2,900,000 tons, a million tons would be synthetic. Leases are now pending for an extra 10,000 acres which Dunlop have selected in Nigeria.

Shadows will reduce Glare from Headlights

GLARE from oncoming cars rates as one of the most unpleasant features of night driving, so the announcement of a fundamentally different method of glare reduction is likely to be particularly welcome. In contrast to the conventional method, in which the headlights beam is dipped, and sometimes deflected to the nearside, the new system employs a mask to cast a shadow over that part of the road occupied by the oncoming car.

Invented by E. P. Bone, of Cincinnati, and being developed at the Battelle Institute, Columbus, Ohio, for the Midland Discount Co., of Cincinnati, the system employs a photoelectric tube mounted on the offside to react to the oncoming car's offside headlight. As the car approaches, a vane moves in front of the photo tube to position itself in relation to the oncoming light, this vane electrically controlling the position of a corresponding vane in the headlight which casts the shadow. The system is made feasible by using an ellipsoidal reflector in the headlight, and is claimed to enable the driver of a car so equipped to see forward between 500 and 1,000 ft when meeting another vehicle.

No Need to retire at Tipton Factory

EMPLOYEES at Revo Electric Co., Ltd., have no need to retire at 65 if they do not want to. When due to stop working either because of age or ill-health, they can apply to enter the company's special "long service department," which has been designed as a workshop and equipped with tools for light work. The management decides whether or not a pensioner can join the department, but once the employee is accepted he can choose his own hours of work. Payment is on a piece rate basis. In charge of this department, incidentally, is a young man, who is constantly visiting all other parts of the works looking for light, interesting work for the men to do.

Safe Truck Drivers

SOME time ago the Industrial Truck Manufacturers' Association issued a booklet dealing with basic design codes and other factors inherent in the production of safe transportation equipment. The booklet's success has led to the publication of an excerpt from it as a separate pamphlet, which is specially designed to appeal to the driver of the equipment. Entitled "Operator's Safety Code," it illustrates numerous do's and don'ts, and lists the hazards common to truck operators. The Association is at 94 Petty France, London, S.W.1.

Street Lighting Installations in London

Two street lighting schemes involving mercury and fluorescent lamps have been completed in, or near, London. Fittings for both installations were supplied by the British Thomson-Houston Co., Ltd.

The installation of mercury lighting was on the A.40 London to Fishguard arterial road at Ealing (see left below), and is notable for the fact that it is in the vicinity of London Airport, involving the risk of interference with air traffic. Consequently aero-screened Sapphire mercury vapour enclosed reflector lanterns were used, housing 400 W lamps. About 90 of these fittings were mounted at a height of 25 ft and both centrally as a twin-bracket arm installation, and at opposite intervals. Light distribution of these lanterns causes no risk in the air. The scheme was planned by the Ealing Borough Council and installed by the North Midlands Engineering Company, Ltd.

Kensington Rd. and part of Knightsbridge in Westminster (right) were the sites for the fluorescent system. This is the second scheme of its kind installed by the City Council, and follows the success of the first and pioneer installation in Bond St., which was inaugurated in 1946. Eighty 5 ft. lanterns each housing four 80 W tubes were mounted at 25 ft either singly or in pairs. Specially designed Westminster Council steel columns with ornamental cast-iron sleeves were used and placed both centrally and on the kerb. Incidentally, an illumination of 11,000 lumens per 100 ft of road was achieved compared with the normal maximum of 7,000 lumens

Edinburgh Electricians say Electricity is Useless

WE have heard of some reactionary electricians resident in the Edinburgh area. At a meeting of the Edinburgh Electrical Society before Christmas a debate took place on a motion by Mr A. D. Mackie "deploring the use of electricity." More surprising perhaps is the fact that the motion was successful by 37 votes to 34. Mr Mackie maintained that electricity disrupted our way of life and was the cause of many nervous breakdowns. Supporting him, Mr G. A. McLennan said much raw material was wasted by using coal to generate electricity. Fortunately there were some stalwarts in defence of electricity. Mr E. O. Taylor pointed out the advantages of electricity, not least among them the fact that with electricity there was no fear of air pollution. Mr F. S. Kynloch spoke of the success of the N. of Scotland Hydro-Electric Board.

NEWS IN BRIEF

Speaking at Lochaber district council meeting a councillor asked the N. of Scotland Hydro-Electric Board to give preferential tariffs to Highland homes and industries. He said unless they could get electric power at rates likely to attract industry, people would leave to find work in the south.

Maidstone branch of the E.A.W. has been formed. Chairman is Mrs B. J. Watson and hon. secretary, Mrs C. P. D. Shaw.

Annual Hoover Ltd. apprentice prize-giving was held on 14 Dec. at the company's Perivale (Middlesex) headquarters.

Permanent aerials at N. Hessary Tor and Rowbridge TV stations will be delayed, the B.B.C. state. Service from these stations will now become fully effective in Apr. and May. Similarly the opening of the V.H.F. sound transmitting stations at Meldrum and Divis will be delayed until Mar.

Nottingham meeting on Welding for Increased Productivity will take place on 7 and 8 Feb., at Mechanics' Institution, Trinity Sq. It is organised by the British Welding Research Association.

The Ferranti electronic digital computor in the Institution of Applied Mathematics in Rome has been inaugurated by Italy's President, Signor Giovanni Grouchi.

The B.B.C.'s VHF station at Wenvoe, brought into service on 20 Dec., is to have two more transmitters installed to carry the Light Programme and the W. of England Home Service. The two new transmitters will be ready in the spring. Transmissions of the W. of England Home Service will be on a temporary basis, as permanent arrangements for this programme have not yet been decided.

In appreciation of services rendered, Coventry branch of E.A.W. have presented an electric cooker to the Midlands Electricity Board.

QUESTIONS IN PARLIAMENT

Power Breakdown

A STATEMENT on the power failure in the Newcastle area on 14 Dec. was made in a written reply by Mr Geoffrey Lloyd. He said preliminary reports showed that the interruption of supply was caused by an explosion at 8.30 a.m. in the switching gear at Stella South substation. That affected switchgear at other points of the "grid" transmission system, and also circuits leading from Dunston power station, and interrupted the supply to the N.E. Electricity Board's distribution system covering Northumberland and N. Durham. Mr Lloyd went on to say that supplies were partially restored by noon and fully by 6.30 p.m. the same day. It was provisionally estimated that some 300,000 kV of power were lost. The cause of the explosion was still being investigated, he added.

Hiring Appliances

THE Minister of Fuel and Power was asked by Mr L. J. Callaghan to issue a directive to prevent the C.E.A. and gas boards from discontinuing the hire of cookers and other domestic appliances to consumers. He explained that the Boards did not propose to withdraw appliances now on hire, but have agreed to limit new hirings.

H.P. Agreements

INTRODUCTION of legislation to ensure that hire-purchase agreements contained details of bank or other charges involved in making payments was suggested by Mr G. M. Thomson. The suggestion was refuted by Mr D. Walker-Smith who said he was not aware that such agreements stipulated a method of remitting instalments which compelled customers to incur bank charges for collection. He understood it was open to the hirer to make his remittance direct to the finance company or its agent.

Monopolies Bill

IT was hoped to introduce the proposed Monopolies Bill as soon as possible after the Christmas recess, Mr D. Walker-Smith stated in a written reply.

Fuel Economy Campaign

SUCCESSES achieved to date as a result of launching the National coal economy campaign on 1 Nov. were illustrated in a written answer by Mr G. Lloyd. He said there had been a remarkable resurgence of effort throughout industry to find ways of economising further since the campaign was opened by N.I.F.E.S. The service had received thousands of applicants for technical advice and assistance, and the Regional Boards for Industry were now approaching managements of nearly 20,000 firms. Each month, Mr Lloyd continued, more firms were turning from coal to oil, and inland fuel oil consumption had already risen 21% this year. The Minister said this evidence confirmed his impression that industrialists were making a determined effort to save at least 2 m. tons of coal this winter.

The Minister added that further substantial economies could be made, and there was no doubt that the campaign for industrial coal economy should be sustained beyond the present winter as part of the country's national fuel policy for the future.

Nuclear Power Stations

IF the nuclear power programme was not expanded, the C.E.A. estimated an additional deficiency of some 2,000 MW generating capacity by 1965-66, Mr W. N. Warbey stated. He asked what steps were being taken to expand the programme. Mr Geoffrey Lloyd said it was too early to say what steps would have to be taken to meet situations arising after 1965. If all went well it might be practicable by the early 1970s to expand the rate of construction of nuclear power stations to meet the total requirement of generating capacity.

A.E.A. Development

LIMITATIONS of scientific and engineering manpower compelled the Atomic Energy Authority to concentrate development efforts said Mr N. Birch. Nevertheless, a number of advanced reactor systems were being examined. Mr W. Warbey had asked what additional resources were required by the Authority to build more than one type of stage two reactors as was done in the U.S.

Nuclear Energy in Germany

FURTHER questions on the supply of nuclear reactors to W. Germany were put by Mr G. Nabarro and Lt-Col A. Neave. They were informed by Mr R. H. Turton that no specific commitment was entered into during the visit here of the Federal German Minister for Atomic Energy. Discussions centred on the administrative problems of establishing and operating a civil nuclear energy project. During the talks it was made clear to the Minister that when German authorities were in a position to make firm requests for assistance in the development of nuclear energy for peaceful purposes, the U.K. Atomic Energy Authority would consider them sympathetically subject to the availability of resources.

P.T. Remissions

THE Chancellor was asked by Mr P. Holman about administrative difficulties in remitting purchase tax on goods taxed in the Budget but altered again in the course of the Finance Bill's passage through the House. Mr R. A. Butler said that if manufacturers or wholesalers had been relieved of any obligation to pay tax during the interim period,

there was no way of ensuring that the benefit was passed on. Arrangements had been made, however, for tax on deliveries in that period to be remitted administratively in favour of the registered concerns on condition that the benefit was, in fact, passed on to customers.

Load Spreading in Scotland

QUESTIONS on load spreading arrangements in Scotland were asked by Mr A. Woodburn last week. Mr J. Stuart said regional boards for industry had discretion to make any necessary arrangements this winter. He understood that the Scottish Electricity Boards had not asked the Scottish Board for Industry to make such arrangements, but they were watching the position carefully.

Electronic Computers

SEVERAL electronic computers were in use in the Civil Service for mathematical work and less elaborate machines were used in some Government Departments on clerical work, Mr R. A. Butler told Cdr J. F. W. Maitland, who suggested more extensive use of these machines in Ministries and the Civil Service. Scope for further use of computers was being studied continuously.

Exports to China

VALUE of U.K. exports of electrical machinery, apparatus and appliances to China in first nine months of this year, was £41,334. Mr P. Thorneycroft gave this information in a written reply to Mr A. E. Hunter.

Superannuation Query

EMPLOYEES of the C.E.A. formerly with the Midland Electricity Corpn. were not allowed to join the new superannuation scheme, alleged Mr A. Hardeson, who wanted to know the reason. Mr Geoffrey Lloyd explained that the new scheme was designed for manual workers who were not covered previously. Former employees of the Midland Electricity Corpn. were not eligible because they were already covered by arrangements existing before nationalisation.

Sayings OF THE WEEK

"The outlook for the electrical contractor has never been more promising than at the present time." . . . SIR HERBERT BARBER, J.P., at the dinner of the Fylde branch of the E.C.A.

"A typical English business director probably still feels that there is something ungentlemanly and vulgar about too much competition." . . . in a U.S.A. Senate report.

"Perhaps the day is not too far distant when the community will realise that the man who sells knowledge is worth as much as the man who sells gas stoves, television sets and razor blades." . . . MR J. RIORDAN, president, Bristol branch of National Association of Schoolmasters.

ELECTRIC SUPPLY NEWS

Argyllshire

Construction work on the North of Scotland Hydro-Electric Board's Kilmelford hydro-electric scheme is well advanced, and the engineers are hopeful that it will be in commission next Mar. The scheme utilises a catchment area of 11 sq miles, with an annual rainfall of about 74 inches. The 200 ft dam in the Pass of Melfort is nearing completion, as is the station itself, where one 3,000 kW turbo-alternator is being installed. Annual output of the station is estimated at 9 million units.

East Midlands

Asked if the East Midlands Electricity Board were wasting money on conversion schemes instead of getting on with supplying places with no power supply at all, Mr J. Mould, deputy chairman of the Board, recently stated that standardisation must be achieved. Any cut in spending would result only in a worsening of the present position. In Leicester there were 8,000 consumers whose system must be altered, while in Nottingham a much bigger conversion scheme had to be tackled. In the East Midlands as a whole, the task was so great that conversion would take 25 years at the present rate, he said.

Kidderminster

Electricity supply in this town has now been converted to a.c. system, completion of the task being marked by a formal ceremony at the Midlands Electricity Board's premises in New Road, when the mayor of Kidderminster, Ald Lt.-Col D. Burcher, switched off for the last time the remaining d.c. supplies. The change over work, begun four years ago, had involved the conversion of 886 consumers' systems, together with reinforcement of the distribution system, costing over £148,000. Mr W. S. Lewis, chairman of the Board, said total capital expenditure in the district had been running at the rate of £140,000 annually, but this rate would have to be reduced slightly over the next 18 months in accordance with government policy.

Londonderry

A site at St. Columb's Park is being made available for the new power station to be erected by the Northern Ireland Ministry of Commerce, to which we referred last week. The site will permit expansion of the station up to 150 MW capacity. The project will probably involve the extension of the Board's h.t. transmission lines from the present terminals at Omagh and Ballymena to connect with Londonderry Corporation's existing system.

Plymouth

The mouth of the River Erme has been suggested as a suitable site for an experimental nuclear power station to be built by the C.E.A. The Plymouth Chamber of Commerce has made the suggestion, and at its meeting recently, the secretary, Mr H. Michell, said the Authority had expressed interest in the suggestion, but had stressed that considerable detailed investigation would be necessary before it was possible to say whether the particular location was suitable. Members of the Chamber were unanimous in their decision that the development and completion of the Plymouth "B" power station was of more importance at present than the erection of a nuclear power station at Erme Valley—desirable though the project might be. Mr Michell said that an Ordnance Survey map locating the proposed sites at the River Erme for the new nuclear station had already been sent to the C.E.A. by the Chamber.

Yorkshire

Electricity was brought to the Littondale Valley at a formal ceremony performed by Mr A. Tennant, chairman of Settle Rural Council, a few days ago Mr D. Bellamy, chairman of the Yorkshire Electricity Board, said that the extension of supplies to Upper Wharfedale and Littondale had cost the Board about £100,000 and had provided current in 26 villages and hamlets. In recent years the Board had spent something like £3 millions on rural electrification schemes, in the development of which about 50,000 poles had been erected. Subsequently, Mr W. A. Anderson, chairman of Skipton Urban Council, after congratulating the Board on the progress made in rural electrification, said that to complete the Upper Wharfedale scheme another five miles of overhead line had to be taken up from Langstrothdale to Oughtershaw, and he hoped this would not be interfered with by any cut in the Board's expenditure.

LIGHTING SCHEMES

Blackpool. The Corporation Electrical Services Committee has decided not to continue with the joint scheme between the corporation and local contractors for the floodlighting of properties on the promenade during the Illuminations. The five-year agreement has now expired.

Brentford. The Highways Committee has put forward a £100,000 plan to convert gas street lighting to electric.

Crofton. The Parish Council has been given authority to proceed with a £3,032 electric street lighting scheme.

Croydon. Highways and Street Services Committee have approved a £4,389 scheme for sodium lighting at Ballards Farm Estate.

Sunninghill. The Finance Committee of Berks C.C. has approved the Parish Council's £9,000 plan on street lighting.

Wigan. It has been agreed to carry out the first two years' work in conversion of street lighting from gas to electricity.

COMPANY ACTIVITIES

ANOTHER complicated scheme to get rid of the excessive rights of Hoover's 1,600,000 1s. "A" Ordinary shares has been put forward. Following it, Hoover Ordinary fell 7½d. to 39s. 1½d. and the "A" shares 1s. to 51s. 6d. This time the scheme has been thrashed out between the leaders of the two sets of shareholders, including investment trusts, insurance companies and pension funds. Helbert Wagg and Co., the bankers, and Deloitte Plender Griffiths and Co., were also called in. In the market's view the scheme will go through this time. Leaving out all the details, it means that the 1s. "A" Ordinary shareholders are getting a share bonus of 625% instead of 525% under the previous scheme. The bonus consists of 135 new non-voting "A" shares of 5s. each and 10 Ordinary shares of 5s. each to replace every 100 present "A" 1s. shares.

A feature of this scheme is that the future income of the present "A" shareholders depends on the liberality of the directors. The higher the proportion of profits they distribute the better they will fare in relation to the existing Ordinary shareholders. Without making any promises, the theme of the statistics given with the plan suggests that when the incubus of the present "A" shares is removed the dividend policy will be more generous. As regards 1955, however, the return is dubious. Profits before tax are expected to be down from approximately £4·6m to £3·75m, which in any case would have meant a reduction of last year's equivalent of 600% on the "A" shares. An interim dividend of 10% already paid on the Ordinary shares is also to be paid on the new "A" Ordinary, and a final of between 50% and 60% is estimated.

In the event of the directors choosing half way between those two, the current year's loss of income by the "A" shareholders will be just the same as if no scheme had been agreed to. Should they pay the lower final of 50% their loss will be greater, but should the final be 60% they will have gained a little. But no change is being made in the voting strength of the two parties. Although the new "A" shares have no votes at all, the present "A" shareholders get their present equivalent strength of votes through their allotment of Ordinary shares. Both the Ordinary and the new "A" Ordinary will in future rank equally for dividend.

An excellent review of the year's work was given by Dr H. Schofield, chairman of Crabtree Electrical Industries Ltd., at his nineteenth annual meeting. He spoke of the hard work necessary to achieve profits in face of increased costs of non-ferrous metals and higher wage agreements. He also spoke of the encouraging reception given to his group's new products, including an entirely new range of sockets, and sockets combined with a.c. switches, and other products. Work is well advanced on the first part of a new factory at Brownhills and the company has just occupied new extensions at Lincoln Works. A new sales depot has also been opened up at Bristol and more commodious and convenient premises are to be taken over in London. During the first four months of the current year, trading has been better than in the corresponding period. Having been a careful dividend payer in the past, Dr Schofield is particularly incensed by the latest increase in the tax on distributed profits. He has no fears about "credit squeeze" and announced that the group's finances were strong.—*From our City Correspondent.*

Crabtree Electrical Industries Ltd.

Past endeavours are now yielding excellent results, new products having been given a grand reception by the trade, Dr H. Schofield, the chairman, stated at the annual meeting recently. Over the last two or three years the South African subsidiary has also made steady progress and is now making a useful contribution to the profit figure. Work is well advanced on a new factory at Brownhills, and new extensions have just been occupied at the Lincoln Works. Commitments for capital expenditure are listed in the accounts at around £100,000. The company is shortly moving to more commodious and convenient premises in London, while the Manchester Depot is to have improved facilities. During the first four months of the current year, trading has been better than for the corresponding period last year, and the directors are continually looking for ways to improve productive capacity, Dr Schofield adds.

Year to 31 July	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1951	458,922	154,861	46	17½	44/3	33/9
1952	357,244	111,983	33	17½	36/–	30/–
1953	241,076	62,944	16	17½	32/6	23/9
1954	288,075	91,093	25	20	33/1	23/9
1955	353,073	123,588	33	20	34/6	26/6

Hartley Baird

The acquisition by this group of the whole of the issued share capital of H. Fisher (Oldham) Ltd. to which we referred on 15 Dec., has been arranged by the allotment of 160,000 Ordinary shares of 1s. each, fully paid, it has now been stated.

Hoover Ltd.

New proposals have been put forward by the directors with the aim of eliminating the existing 1s. "A" Ordinary with all their special dividend rights. The first step proposed is the capitalisation of £320,000 of general reserve to make a free issue to "A" Ordinary holders of 6,400,000 "A" Ordinary 1s. shares in the ratio of four-for-one. The 1s. "A" Ordinary will then be consolidated into 5s. shares. The second stage is to utilise another £180,000 of reserve in making a free issue to "A" Ordinary holders of 560,000 "A" Ordinary 5s. shares in the proportion of 35-for-100, and 160,000 Ordinary 5s. shares in a ten-for-100 ratio. The present £1,870,000 issued Ordinary will be converted into 7,480,000 Ordinary 5s. shares and the authorised capital raised to £3,060,000. Treasury consent to the issues has been obtained. The directors estimate that the consolidated net profit before taxation, for the year 1955, will be approximately £3,750,000. On this basis, they expect to recommend in February next a final dividend of between 50% and 60% on the reconstructed Ordinary and "A" Ordinary, making a total dividend for the year of between 60% and 70%.

McKechnie Bros.

The shares of this well known brass and copper concern may be marketed very shortly, and it is believed that capitalisation of the general reserve is under consideration. The present capital amounts to over £1,000,000, of which about one-fifth is in 6% Cumulative Preference shares and the remainder in Ordinary and "A" Ordinary shares.

Murphy Radio Ltd.

Exports of sets and kits for assembly this year have been increased by some 12% in value compared with 1954. Mr E. J. Power, chairman and managing director, has stated. As to prospects for 1956, he warns that in common with many British exporters of goods other than radio, the firm is being keenly pressed on price by oversea importers.

Phoenix Telephone and Electric Holdings

It is proposed to make a one-for-four rights issue of 197,500 5s. Ordinary shares. The additional working capital is necessary because of the growth of the business, the directors state.

Telegraph Construction and Maintenance Co.

The directors announce that in response to applications for the 68,862 shares offered to employees of the group, out of 1,750 employees who were eligible, 340 have been allotted a total of 43,458 shares. The balance of shares is being retained for offer later to employees not at present eligible to take up shares.

Yorkshire Copper Works

Larger profits for the year ended 31 July last, has resulted in an increase in the dividend. After charging taxation, etc., the net profit is £585,744 compared with £464,911 for the previous year. A final dividend of 6% makes the total distribution 12%—an increase of 2%.

Dividends Declared

Waygood-Otis Ltd. Interim 40% (*same*).

General Cable Manufacturing Co., Ltd. Second interim of 18%, making a total of 30% (*same*). There is to be no further payment for the year.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

30 Dec.—Kingston-on-Hull T.C. Installation at Greatfield primary school.—See 15 Dec. issue.

30 Dec.—Reading T.C. Wiring of houses on Whitley estate.—See 22 Dec. issue.

31 Dec.—Bristol. Electrical equipment for College of Technology.—See 1 Dec. issue.

31 Dec.—Cheshire. Applications for inclusion on official list for supply of lamps.—See 8 Dec. issue.

31 Dec.—Hastings T.C. Installation in flats and shop at Harley Shute Extension. —See 22 Dec. issue.

31 Dec.—Co. Louth. Installation at Bush vocational school.—See 15 Dec. issue.

31 Dec.—Middleton T.C. Installation in 68 houses and 36 flats.—See 1 Dec. issue.

31 Dec.—Nailsworth U.D.C. Concrete columns and electrical equipment for mercury discharge lighting along A.46. —See 22 Dec. issue.

31 Dec.—West Riding. Contractors invited to apply for names to be included on lists of selected contractors.—Advertised in 17 Nov. issue.

31 Dec.—Worsley U.D.C. Fittings for conversion of gas street lighting to electricity—See 15 Dec. issue.

31 Dec.—Wrexham R.D.C. Installations in 110 houses at Cefn, Esclusham Below, Gwersyld, Penycae and Ruabon.—See 1 Dec. issue.

1 Jan.—Litherland U.D.C. Installation in houses in Southport Rd.—See 22 Dec. issue.

2 Jan.—Finsbury B.C. Lamps in year from 1 Apr.—See 15 Dec. issue.

2 Jan.—Isle of Wight. Wiring of six council houses at Newchurch. Clerk of R.D.C., 30 Pyle St, Newport.

3 Jan.—Watford T.C. Street lighting at Cecil Lodge, Abbots Langley.—See 22 Dec. issue.

4 Jan.—Skelton and Brotton U.D.C. Wiring and installation of fittings in 16 houses on Skelton estate. Engineer and Surveyor, Council Offices, Skelton-in-Cleveland.

4 Jan.—Stockton-on-Tees T.C. Group A concrete columns, and sodium vapour discharge lamps, lanterns and ancillary equipment, for relighting A.19.—Advertised in 15 Dec. issue.

5 Jan.—Rochdale T.C. Lighting and power installation at Norden secondary modern, junior and infants' school. Borough Surveyor, Town Hall.

6 Jan.—Camberwell B.C. Supply of electrical fittings, cables and conduit. Borough Engineer and Surveyor, Town Hall, S.E.5.

6 Jan.—Dublin. Installation of St. Mac Dara's National School, Carranoe.—See 15 Dec. issue.

7 Jan.—Bootle T.C. Lamps, cables and other electrical goods in year from 1 Apr. —See 22 Dec. issue.

7 Jan.—Castleford T.C. Sodium discharge lamps on concrete columns along Lock Lane.—See 22 Dec. issue.

7 Jan.—Dagenham T.C. Lamps, cables, conduit and accessories in year from 1 Apr.—See 8 Dec. issue.

7 Jan.—Ruislip (Middlx.) U.D.C. Supply of lamps from 1 Apr.—See 1 Dec. issue.

9 Jan.—Bridlington T.C. Re-equipment of Burton Agnes pumping station with electrically operated centrifugal pumping plant.—See 15 Dec. issue.

9 Jan.—Lanarkshire. Mercury discharge lanterns with chokes and capacitors for lighting A.8.—See 15 Dec. issue.

9 Jan.—Romsey T.C. Lighting points in 22 houses at Lansdowne Close.—See 15 Dec. issue.

9 Jan.—Whitley Bay T.C. Pedestrian controlled electric vehicles for road sweepings.—See 15 Dec. issue.

11 Jan.—Bromsgrove U.D.C. Supply and erection of 140 W sodium lighting with 47 concrete columns and totally enclosed lanterns for Group A scheme along Birmingham Rd, A.38. Engineer and Surveyor, Council Hse. Deposit £3. 3s.

11 Jan.—Dublin T.C. Sewage pumps and electric motors and storm water pump and electric motor for Kilbarrack pumping station.—See 27 Oct. issue.

13 Jan.—Co. Limerick. Installation at courthouse.—See 15 Dec. issue.

14 Jan.—Bath T.C. Supplies required in year from 1 Apr. include l.v. electric cables, discharge lamps, control gear and fittings, tungsten lamps and fittings, steel columns, lanterns and time switches for street lighting. City and Waterworks Engineer, Guildhall.

14 Jan.—Winchester. Supply of electric lamps to 14 hospitals for Group Hospital Management Committee, in year from 1 Apr. Supplies Officer, Royal Hants. County Hospital, Winchester.

16 Jan.—Belfast. Electrical installation in St. Monica's intermediate school, Ravenhill Rd. McLean and Forte, architects, 37 Malone Rd. Deposit £5. 5s.

16 Jan.—Keynsham U.D.C. Installation in 120 dwellings on Park West estate.—See 22 Dec. issue.

16 Jan.—Mountain Ash U.D.C. Supply of equipment and columns for about forty 45 W sodium vapour units for Group B street lighting on Matthewstown housing site. W. F. Greenway, Engineer and Surveyor, Town Hall.

16 Jan.—Oldham T.C. Supply and erection of concrete columns and lanterns for Group A street lighting. Documents from C. Worswick, Lighting Superintendent, Gas St.—Advertised in this issue.

19 Jan.—Co. Down. Installation at Banbridge intermediate school.—See 22 Dec. issue.

20 Jan.—Lincolnshire. Rewiring at St. George's Residential estate, Stamford.—See 8 Dec. issue.

20 Jan.—Newcastle-on-Tyne. Supply of eleven electric wagon-shunting capstans for Tyne Improvement Commission. J. K. McKendrick, general manager and secretary, Bewick St.

21 Jan.—Halesowen T.C. Class A mercury discharge lamps and Class B fluorescent mercury discharge lamps on concrete columns for street lighting.—See 22 Dec. issue.

21 Jan.—Walton-le-Dale U.D.C. Supply and erection of Group A sodium street lighting on concrete columns along A.675 (107 columns) and B.5257 (48 columns). Engineer and Surveyor, Council Offices, Bamber Bridge.

25 Jan.—Fareham U.D.C. Fittings and lamps in year from 1 Apr.—See 22 Dec. issue.

26 Jan.—Belfast T.C. 33 kV and lower voltage cables and accessories.—Advertised in 8 Dec. issue.

27 Jan.—Belfast T.C. Five 33/6·6 kV 12,500 kVA outdoor stepdown transformers with on-load tap changing equipment.—Advertised in 8 Dec. issue.

28 Jan.—Swansea T.C. Electrical supplies in year from 1 Apr.—Advertised in 22 Dec. issue.

No date stated.—Liverpool. Lamps for Fazakerley Hospitals Committee.—See 15 Dec. issue.

No date stated.—N. of Scotland H.E. Board.—132 kV isolators, 33 kV switchgear, neutral earthing resistances and ancillary equipment, for Persley substation.—Advertised in 15 Dec. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 97 queries answered this week

"Monarch" washboilers, makers of? T.B.—Eveson Bros (1928) Ltd., Monarch Works, Lye, Stourbridge, Worcs.

"ATEA" equipment made by Automatique Electrique S.A., address for? G.K.—22, Rue du Verger, Anvers, we can find no trace of a British address.

Bronze or Brass finish cord absorbers, makers of? S.B.—Sturge and Co., 37, Sheepcote St, Birmingham 15.

"Guelph" stove, address for? S.E.B.—T. Eaton Co., Ltd., 61 Conduit St, W.1.

"Trivector" meters, makers of? J.A.B. —Landis and Gyr Ltd., Elgee Works, Victoria Rd, W.3.

"Fonadek" telephone amplifiers, makers of ? B.I.—Fonadek (Branson) Ltd., Vivian Rd, Birmingham 17.

"Gromex" p.v.c. protective edgings, address for? T.E.—British Insulated Callenders Cables Ltd., 21 Bloomsbury St, W.C.1.

"Roanoid" plastic bell pushes, address for? G.A.—Roanoid Ltd., 95 Bothwell St, Glasgow C.2.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

27 Jan.—South Africa. Stores Dept., S. African Railways, Johannesburg, invite tenders (no. C.5515) for supply of electrical substation equipment including 6·6 kV 150 MVA 4-panel switchboards, 500 kV 6,600/400 V 3-phase O.N. indoor type transformers, 400 V 25 MVA 8-panel switchboard, separate pedestal mounted 400 V 25 MVA circuit-breakers and cable earthing devices for h.t. switchboard. B.o.T. (Ref.: ESB 27643/55).*

10 Jan.—India. Govt. of Madras Electricity Dept. require supply of h.t. insulators, comprising pin insulators, spindles, strain insulators, strain clamps. Tender no. E.287. Dept. is at 157 Mount Rd, Madras. B.o.T. (Ref.: ESB 27557/55).*

10 Jan.—Thailand. Supply of two electric generators, 50 cycles, 25 kW continuous capacity, 3-phase, 220/380 V, with separate control panel for each unit. Purchase to be financed by I.C.A. U.S.A. Operations Mission to Thailand, 275 Samsen Rd, Bangkok. B.o.T. (Ref.: ESB 27453/55).*

13 Jan.—South Africa. Stores Dept. of S. African Railways, Johannesburg, invites tenders (C.5483) for supply of total of 51,100 lb of hard drawn copper wire. B.o.T. (Ref.: ESB 27364/55).*

13 Jan.—South Africa. Supply of (a) 56 transformers (50 kVA to 750 kVA) of 3-phase double-wound core type, oil-immersed, natural cooled and for outdoor service; and (b) total of 175,250 ft underground electric cable. Separate tenders, contract Nos. E.2654 and E.2661 resp., invited by City of Durban Electricity Dept., Municipal Buildings, West St. B.o.T. (Refs.: ESB 26876/55 and 2685/55 resp.).*

13 Jan.—South Africa. Supply of 5,000 ft of insulated electrical single-core cable. Contract C.5512. Stores Dept., S. African Railways, Johannesburg. B.o.T. (Ref: ESB 27367/55).*

14 Jan.—Rhodesia and Nyasaland. Supply and erection of 330 kV cable and ancillary cables; shunt compensating reactors; and main and auxiliary switchgear, for Kariba Hydro-Electric scheme. Details of qualifications, etc., to Secretary, Federal H.E. Board, P.O. Box 630, Salisbury, S. Rhodesia, and Merz and McLellan, Carliol Hse, Newcastle-on-Tyne, by above date.—Advertised in 15 Dec. issue.

19 Jan.—South Africa. Union Tender and Supplies Board, 291 Bosman St, P.O. Box 371, Pretoria, require 26 vacuum cleaners and 33 floor polishers to various specifics. B.o.T. (Ref.: ESB 26957/55).*

20 Jan.—South Africa. Supply of six sets of 11 kV 3-phase outdoor type pole mounted oil filled automatic reclosers. Contract E.2641. City of Durban Electricity Dept., Municipal Buildings, West St. B.o.T. (Ref.: ESB 26877/55).*

23 Jan.—Egypt. Cairo Tramway Co. require 100 to 125 trolley buses. Documents at £E.5 from company's offices at 1 Sharia Maspero, Cairo.

26 Jan.—South Africa. Supply of diesel engine alternator sets comprising 1·9 kVA prime mover plant and 4 kVA standby plant, etc. Union Tender and Supplies Board, 291 Bosman St, P.O. Box 371, Pretoria. B.o.T. (Ref.: ESB 27359/55).*

27 Jan.—Australia. Supply and erection of 415V 3-phase 50-cycles switchgear with control and metering equipment for Mackay Harbour Board. Contract 15A. Secretary of Board, Mackay, N. Queensland. B.o.T. (Ref.: ESB 27056/55).*

31 Jan.—New Zealand. Supply of cable test equipment, including pulse echo, high voltage, capacity unbalance and insulation resistance test sets. Tender No. P. and T. 150/8492. Director General, Stores Div., G.P.O., Wellington.

7 Mar.—Australia. State Electricity Commission of Queensland invite tenders (specif. No. 523) for supply, erection, etc., of convertible engine driven electrical generating plant for Emerald Shire Council. Commission is at Scottish Union Hse, Eagle St, Brisbane. B.o.T. (Ref.: ESB 27057/55).*

14 Mar.—Australia. Tenders (specif. No. 522) invited for supply of engine-driven generating set wanted by Winton Shire Council. State Electricity Commission of Queensland. Copies of specif. available at Office of Agent General for Queensland, 409-10 Strand, London, W.C.2. B.o.T. (Ref. ESB 27129/55).*

14 Mar.—Uruguay. Tenders (2,500) invited for 27·8 km overhead line for 150 kV Montevideo collector system. Administracion General de las Usinas Electricas y los Telefonos del Estado. B.o.T. (Ref.: ESB 25778/55).*

22 Mar.—India. Supply and erection of 220 kV transmission lines from Koyna power station to Bombay Terminal Station. Tender notice 71. Central Purchasing Officer, Govt. of Bombay, Old Custom Hse Yard, Fort. B.o.T. (Ref.: ESB 27058/55).*

26 Mar.—India. Govt. of Bombay invites tenders (notice No. 70) for supply and installation of various power transformers for Koyna Hydro Electric scheme. Central Purchasing Officer, Old Custom Hse, Yard, Fort. B.o.T. (Ref.: ESB 27059/55).*

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Thursday, 22 December

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	390½	−12½	280
,, (3 months)	386½	−10	268½
R.S.T. (Rhodesian Selection Trust) group price*	360	—	—
LEAD, refined pig, min. 99·97% purity (cash)	114½	+1½	105½
,, (3 months)	114½	+1½	104
TIN, refined, min. 99·75% purity (settlement)	828½	−6½	694
,, (3 months)	809	−7	695
ALUMINIUM, ingots 99·99·5%	171	—	156
ZINC, virgin, min. 98% purity (cash)	99	+⅜	83⅜
,, (3 months)	96½	+⅜	82½
RUBBER No. 1, RSS. spot (per lb.)	38d.	+1⅛d.	27¼d.
,, c.i.f. basis, ports. Jan. (per lb.)	37d.	+¼d.	26½d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	56½	—	52½
Mild Steel Tape (0·04 in.)	43½	—	40½

(*Fixed price c.i.f. U.K., now subject to change at 24 hours' notice, to "consumers willing to instil a degree of stability into the resale price.")

Contracts Placed

Durham T.C. Electrical installation at Biddick county school, Washington, R. Robson, £1,444.

Loughborough T.C. Installations in houses built under two contracts on Ashby Rd estate, J. H. Hickling Ltd., £985 and £1,230.

Manchester T.C. Electrical work in shops, flats and maisonnettes in Langley estate (contract No. 233) Sadler and Kinsey Ltd.

Sheffield. Reorganisation of electricity supplies at City Hospital, Barrs (Sheffield) Ltd., £2,095.

Trade Notes

Licensees. Quasi-Arc Ltd., Bilston, Staffordshire, announce that they are now sole licensees in this country and the Commonwealth for Heliarc welding equipment, and will be handling the Heliarc spot welder, the semi-automatic welder HWM–1 and the fully automatic controlled arc welder HWM–2.

E.W.F. Elected members of the Electrical Wholesalers Federation are: Armos Radio and Electrical Co., Ltd., 60 Larkshall Rd, Highams Pk, London, E.4; G. D. Harrison and Sons Ltd., 55 Northgate, Huddersfield; and A. J. Wright (Electrical) Ltd., 67/69 Victoria St, Liverpool 1.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

E.E. in design. 743,217. Class 7. Steam gas and water turbines, i.e. engines, motors, etc. 743,218. Class 9. Electrical and electronic apparatus, etc. 743,219. Class 11. Apparatus for lighting, heating, cooking, refrigerating, etc. 743,220. Class 12. Apparatus for locomotion, etc. English Electric Co., Ltd., Queen's Hse, Kingsway, W.C.2.

C.A.G.E. B740,343. Class 9. Electrical, electronic, wireless and television apparatus and instruments. Communication and General Equipment Ltd., 86 Broadway, Chesham, Bucks.

Telecommander. 740,918. Class 9. Radio transmitting and receiving instruments, etc. James Slater and Co., 79 Newhouse Rd, Marton, Blackpool.

Magseal. 744,244. Class 9. Magnetic switches and relays. G. M. Giannini and Co., Inc., 580 Fifth Ave, New York 36, U.S.A.

Semper Contendo in design. 744,899. Class 9. Electrical apparatus for testing, recording and indicating fluid pressures in aircraft, etc. Avica Equipment Ltd., 50 Pall Mall, S.W.1.

Silcom. 746,235. **Deciplex.** 746,236. Class 9. Apparatus and instruments, calculating machines and checking (supervision) apparatus. Southern Instruments Ltd., Frimley Rd, Camberley, Surrey.

Hallford. B745,533. Class 11. Air conditioning installations, etc. J. and E. Hall Ltd., 10 St. Swithin's Lane, E.C.4.

Heronflex. B745,401. Class 17. Non-metallic hose incorporating a heating element. Heron Heating Devices Ltd., Ardea Works, Church St, Newcastle-on-Tyne 6.

BUSINESS PROSPECTS

Home

Accrington. It is proposed to rebuild two-storey premises of Calico Printers' Assoc. Ltd., Broad Oak Print Works.

Alloa. Plans approved for £148,000 development scheme at B.E.P. Works in Caledonian Rd for Harland Engineering Co.

Bath T.C. Plans in hand for shops and 3-storey houses on Foxhill estate.

Bebington T.C. Erection of 48 flats in three 3-storey blocks in Town Lane, nr. Bebington. Borough Engineer and Surveyor, Brackenwood, High Bebington.

Bedford R.D.C. Further 50 houses to be built at Wootton.

Belford (Northumb) R.D.C. Construction of five blocks comprising 20 flats on Meadows estate. K. Glover, architect, Beadnell, Chathill.

Birmingham. Library and lecture theatre to be built at medical school at Edgbaston for University. Scheme in early stages. Architects are Lanchester and Lodge, 10 Woburn Sq, London, W.C.1.

Boreham Wood. R.C. junior and infants' school to be built at estimated cost of £15,324.

Boston T.C. Four shops, four houses and two flats to be built at junction of Shaw and Ingram Rds.

Bristol T.C. Negotiations in hand for completion of Bedminster Down secondary school. Estimated cost, £97,318.

Buckfastleigh. Plans approved for motor showroom and store at Dart Garage for Willcocks and Sons Ltd., Dial Foundry.

Caernarvon. T.C. recommended to appoint L. C. Wakeman and Partners, Bron Ala, North Rd, as quantity surveyors for additional office accommodation.

Cardiganshire. Construction of primary school at Cwrtnewydd and Trewen. County Architect, County Office, Aberystwyth.

Chester. Two-storey building to be built on Sealand trading estate, off Sealand Rd for Raleigh Cycle Co., Ltd.

Congleton. Plans approved for extensions to factories in Buxton Rd, Buglawton, for Congleton Board Co., Ltd., and in Back Lane for Aerialite Ltd.

Corby U.D.C. Ministry permission sought to go ahead with construction of new swimming bath. Cost estimated at £118,700.

Gazette Announcements

COMPANIES ACTS

Noble and Gregory Ltd. First and final dividends of 4s. 6d. in £ payable tomorrow (30 Dec.) at Govt. Buildings, 10 St Mary's Sq, Swansea.

BANKRUPTCY ACTS

Intended Dividends

Southampton. Sidney F. Wilkins, electrical engineer trading at 6 Queen St, Lymington. Last day for receiving proofs, 30 Dec. Trustee is L. F. Hope Jones, 73 High St, Lymington, Hants.

Receiving Orders

London. Eric J. Thompson, electrician of 3 Queens Ave, Muswell Hill, N.10. Date of receiving order, 15 Dec.

Carlisle. James V. Little, electrician trading at 25 Park Rd, Haltwhistle, Northumberland. Receiving order dated 15 Dec.

Cornwall. Erection of extensions at both Falmouth grammar school for boys and Fowey county primary girls' school. Architects are Cowell, Drewitt and Wheatly of Lloyds Bank Chambers, Penzance, and Taylor and Crowther, of 66 Lemon St, Truro, resp.

Dewsbury. Plans submitted for rebuilding Crown Mills in Mill St East, by Yorkshire Paper Stock Co., Ltd.

Dorset. School to be built at Swanage, and science laboratory and art room at Swannage grammar school, at resp. estimated costs of £95,000 and £26,300.

Co. Down. Construction of St. John's primary school at Gilford. W. H. McEvoy, quantity surveyors, Ulster Bank Chambers, 73 May St, Belfast.

East Barnet. It is proposed to erect boys' secondary school on Wilderness site at estimated cost of £229,550.

Edinburgh. Approval given for erection of factory on Sighthill industrial estate by Nuclear Enterprises Ltd. of Winnipeg. Also nurses home and training school costing about £56,000 to be built at Western General Hospital.

Glasgow. It is proposed to erect new shipping terminal at Broomielaw. Planning permission granted in principle to application by Clyde Navigation Trust, 16 Robertson St. C.2, on behalf of Burns and Laird Lines Ltd.

Grangemouth. Power station at Refinery to be extended by Grangemouth Petroleum Refinery Ltd., Bo'ness Rd, at cost of about £45,000; quantity surveyors are Scottish Oils Ltd., Middleton Hall, Broxburn, W. Lothian.

Grimsby R.D.C. Total of 70 houses to be built during 1956.

Havant (Hants) U.D.C. Scheme submitted for Ministry approval for extensions to town hall.

Hindley U.D.C. Construction of 71 houses on Wooddagger estate. Engineer and Surveyor, Town Hall.

Inverness. A Norwegian wood company are proposing to erect £5 million factory on Longwan industrial site.

Isle of Ely. Architects for erection of Whittlesey junior school are Ruddle and Wilkinson, Long Causeway Chambers, Peterborough.

Kendal. Plans in hand for erection of police H.Q. in Busher Walk.

Kensington. Sir William Holden, 20 Angel Court, E.C.2, may be appointed to prepare architectural layout for Kensal New Town area.

Kirkcaldy. Dean of Guild Court approved erection of 5-storey building at Scottish Linoleum Works, South Factory, Nairn St, for M. Nairn and Co., Ltd., Victoria Rd. Approval given by S.E. Hospital Board for extension to surgical dept. at Victoria Hospital, estimated to cost £625,000.

Larne (Antrim). Technical school to be built in grounds of Gardenmore Hse.

Letchworth. It is proposed to erect infants' school on Grange estate. Cost estimated at £49,804.

Lindsey. Erection of junior school in Grange Lane. A. Ronald Clark, county architect, County Offices, Lincoln.

Lisburn (Antrim). Territorial and Auxiliary Forces Assoc. to erect T.A. Centre in Wallace Ave. Estimated cost £80,000.

Loughborough. New laboratory block in Ashby Rd proposed by Governors for College of Technology.

Luton. Experimental hangar to be built at Luton Airport for Hunting Percival Aircraft Ltd. Architects are R. Mountford, Piggott and Partners, 3 Cromwell Place, London, S.W.7.

Old Fletton (Hunts) U.D.C. It is proposed to build 16 houses at Stanground, and 10 bungalows off Coneygree Rd.

Pembrokeshire. Establishment of county secondary school at Tenby has been approved.

Plymouth. Petrol filling station proposed by Maddock Concrete Products Ltd., Embankment Rd. Architects are H. S. W. Stone and Partners, 20 The Crescent, Taunton, Somerset.

Poole T.C. Land at Rockley Point to be leased to A. L. Levy, Hampstead Lane, London, N.6, for first phase in development of holiday camp. Cost estimated at £50,000.

Rochester. Preliminary work to begin on Knight Rd site, Strood, on £1 million factory for Metal Box Co., Ltd., The Langham, Portland Place, London, W.1.

Scunthorpe T.C. Two-storey extension proposed at public baths.

Sunderland T.C. Erection of Farringdon primary junior and infants' school, and extension to College of Art, Backhouse Ave. Borough Architect, Grange Hse, Stockton Rd.

Sutton Coldfield. Single-storey factory in Boldmere Rd proposed by Elisha Mander Ltd., 29 Branston St, Birmingham. Plans have been submitted.

Tring. U.D.C. have approved in principle plan for industrial site near Highfield Rd. Applicants were Kane Products Ltd., 79 Leghorne Rd, London, N.W.10.

Walsall. C. and H. Howe, Gomer St West, Willenhall, planning to erect factory at Landywood, Gt Wyrley.

Walthamstow B.C. Erection of total of 54 flats on sites in Vallentin Rd and Back Rd. Borough Architect, Town Hall, E.17.

Watford. Major extensions proposed at boys' grammar school at estimated cost of £45,650.

Wednesbury. New factory in Portway Rd being planned by Hallen Engineering Co., Ltd. Also, plans approved for extensions to E. Elwell Ltd.'s factory in St. Paul's Rd.

Overseas

Greece. Preliminary information has been given on constructional and electrical work at two naval bases. Latter work included improvement and increase of electrical networks costing approx. £31,000 and £21,000; and erection of 1,200 kW underground power station, including installation of three diesel generators of 400 kW, costing about £83,000. These are N.A.T.O. Infrastructive contracts.

Pakistan. Cottage Industries Inst. at Hyderabad, Sind, would like to contact U.K. manufacturers of electric furnishings, particularly table and floor lamps and lamp shades.

Persia. Council of Ministers has allocated £30,000 for purchase of two generating sets to various specifications. This allocation forms part of the credit for £10m offered by the U.K. for expenditure on U.K. goods and services. Manufacturers are asked to send catalogues and prices to Engineer Faroutanpour, The Iranian Mint, Tehran. B.o.T. (Ref.: ESB 27448/55).*

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Martin's (Eltham) Ltd., 131a Eltham High St, S.E.9. Radio, television, electrical and electronic engineers, etc. Nom. cap.: £100. Dirs.: R. H. J. Martin, P. G. Martin and Mrs I. M. Martin.

Ryhope Electrix Ltd., 77 Ryhope St South, Ryhope, Co. Durham. To take over business of electrical contractor carried on at Sunderland by Chas. M. Marks. Nom. cap.: £100. Dirs.: A. A. Gordon, M. B. Davidson and R. L. Anderson.

Frank Mozer Ltd., 5 Angel Corner Parade, Edmonton, N.18. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Nom. cap.: £1,000. Dirs.: F. Mozer and A. Mozer.

L. M. Ballamy (Components) Ltd., 42 Bedford Ave, W.C. Mechanical, electrical, motor, hydraulic and general engineers, etc. Nom. cap.: £1,000. Permanent directors: L. M. Ballamy and R. Levett.

J. F. Wilkinson and Son Ltd., 351 Wellingborough Rd, Northampton. Heating, ventilating, sanitary, electrical and general engineers, plumbers, etc. Nom. cap.: £5,000. Dirs.: J. F. Wilkinson and Mrs L. P. C. Wilkinson.

Electricians Ltd., 46 Tithebarn St, Liverpool, 2. Nom. cap.: £1,000. Dirs.: H. Taylor and Mrs M. Lowe.

Taylors (Pianos) Ltd., 8 Leicester St, Bedworth, Warwicks. Electrical engineers and manufacturers of and dealers in musical instruments, electrical goods, pianos, radio and television sets, etc. Nom. cap.: £100. Dirs.: A. E. Taylor and Hilda J. Taylor.

Contemporary Electrical Appliances Ltd., 38 Nunhead Lane, S.E.15. Nom. cap.: £100. Dirs.: J. Waldron and R. T. Dunmall.

Wellfare Electrical Co., Ltd., 110 Sutton Rd, Southend-on-Sea. To take over business of television, radio and electrical dealers carried on at Southend-on-Sea by Linton L. Wellfare and Arthur Bate. Nom. cap.: £2,250. Dirs.: L. L. Wellfare and A. Bate.

Elon Tape Development Co., Ltd. Manufacturers of electric tape recorders, electronic recorders, television sets, etc. Nom. cap.: £500. Dirs.: to be appointed by subs. Subs.: T. H. Reps, 35 Finsen Rd, S.E.5; Barbara E. Fisher and F. R. Fisher, 89 Kingsmead Rd, S.W.2.

Engineering and Scientific Research Ltd. Consultants in the businesses of civil, mechanical, electrical and metallurgical engineers, etc. Nom. cap.: £100. Dirs.: Dr H. R. DeVitre, 74 Brooklands Pk, Blackheath, S.E.23; and L. W. Derry, 2 High Pine Close, Weybridge, Surrey.

New Era Industries (Sales) Ltd., Salisbury Hse, Finsbury Circus, E.C.2. To acquire merchandise, etc., from New Era Industries (Tottenham) Ltd., or their nominees only, and to deal with same. Nom. cap.: £100. Dirs.: J. P. J. Ellis, R. B. Kersey and R. T. Holston.

H. and T. Heating Co., Ltd., 8 Kidderminster Rd, West Hagley, nr Stourbridge, Worcs. Suppliers and installers of automatic firing equipment and low and high pressure steam and hot water boilers, etc. Nom. cap.: £2,000. Dirs.: T. W. Hingley and W. Thackery.

Teleproducts Distributors Ltd., 13 Hove Park Villas, Hove, Sussex. Agents and general merchants, and to finance sale of goods and merchandise, and in particular household and office furniture, domestic appliances, musical instruments, wireless apparatus, etc. Nom. cap.: £1,000. Dirs.: H. L. Traherne, C. C. Waring and J. A. Tuffin.

Alwyn Isherwood (Refrigeration) Ltd., 62 George St, Wakefield, Yorks. Manufacturers of and dealers in refrigeration plant, etc. Nom. cap.: £5,000. Dir.: A. Isherwood.

Shandon Automation and Electronics Ltd., 6 Broad St Place, E.C.2. Nom. cap.: £1,000. Dirs.: E. R. Shandon and C. J. Jeffries.

Electric Washers (Northern) Ltd., 16 King Charles St, Leeds. Nom. cap.: £500. Dirs.: A. L. Hopton and Florence Hopton, and G. E. Whitworth.

E. C. Sames and Co., Ltd., 3 Newcomen St, S.E.1. To take over business of builders, contractors and electrical engineers, carried on at Southwark, S.E.1, as "E. C. Sames and Co." Nom. cap.: £25,000. Dirs.: W. R. Lincoln and Mrs E. R. Lincoln, and E. N. Sames.

Electrovac (Scientific) Ltd., 22 Lawn Lane, Hemel Hempstead, Herts. Manufacturers of and dealers in electronic tubes and valves, etc. Nom. cap.: £1,000. Dirs.: To be appointed by subs. Subs.: L. F. Mitchell and S. A. Mitchell.

S. E. C. Products Ltd., 53 Sheep St, Northampton. Manufacturers of and dealers in electrical and mechanical apparatus, etc. Nom. cap.: £1,000. Dirs.: J. T. Holmes and P. A. Young.

Automation Accessories Ltd., Westgate Chambers, Commercial St, Newport, Mon. Manufacturers and suppliers of and dealers in engineers' instruments, etc. Nom. cap.: £1,000. Dirs.: R. P. John and C. J. Chapple.

Leo Kerfoot Ltd., 63 Higher Eanam, Blackburn. To take over business of electrician and radio dealer carried on at 23 New Chapel St, and at 63 Higher Eanam, Blackburn, by Leo Kerfoot. Nom. cap.: £2,000. Perm. dirs.: L. Kerfoot and Mrs H. Kerfoot.

Elliott and Crockett (Holdings) Ltd. To acquire shares, stocks, etc. Power is also taken to buy, sell, import, export and manufacture apparatus and instruments for receiving and transmitting television, wireless, telephonic and telegraphic apparatus, etc. Nom. cap.: £100. Dirs.: Not named. Subs.: D. Wisdom and J. C. Cruttwell, 28 Lincolns Inn Fields, W.C.2.

Plessey Research Ltd., 56 Vicar Lane, Ilford, Essex. Nom. cap.: £1,000. Dirs.: To be appointed by subs. Subs.: Winifred J. Pearmain, 21 Hazelmere Gdns, Hornchurch, Essex; and Dorothy B. Harvey, 6 Empress Ave, Woodford Green, Essex.

MEETINGS TO NOTE

THURSDAY, 29 DEC.

I.E.E. (London). Annual Christmas Lecture for School Children: "Electric Traction." R. Brooks. Savoy Place, W.C.2, 3 p.m. (repeated on 30 Dec.).

Purchasing Officers' Assoc. (West). "Atomic Energy and Industry." M. F. Jones. Royal Hotel, Bristol, 7.30 p.m.

SATURDAY, 31 DEC.

Commercial Travellers' Benevolent Assoc. Annual Court of Governors at Berners Hotel, Berners St, W.1, 12 noon.

MONDAY, 2 JAN.

I.E.E. (E. Anglia). "Industrial Application of X-Rays." F. L. Veale. Crown and Anchor Hotel, Ipswich, 6.30 p.m.

TUESDAY, 3 JAN.

I.E.E. (N. Midland). "Electrical Engineering Industry in the Post War Economy—II." G. L. E. Metz. Elect Offices, 1 Whitehall Rd, Leeds, 6.30 p.m.

I.E.E. (N. Western). "Highland Water Power—Developments of N. of Scotland Hydro-Electric Board." The late T. Lawrie. (To be read by officer of the Board.) Engineers' Club, Albert Sq, Manchester, 6.15 p.m.

WEDNESDAY, 4 JAN.

I.E.E. (Tees-side). "Design—Features of Semi-Outdoor Power Station at Ince." F. H. S. Brown. Cleveland Inst., Middlesbrough, 6.30 p.m.

I.E.E. (S.W. Scotland). "Automatic Circuit Reclosers." G. F. Peirson, A. H. Pollard and N. Care, 39 Elmbank Cres, Glasgow, 7 p.m.

I.E.E. (Southern). "Receiving Aerials for British TV." F. R. W. Strafford. College of Technology extension, Portsmouth, 6.30 p.m.

British Instn. of Radio Engrs. (Merseyside). "Electronic Instrumentation for Nuclear Power." R. J. Cox. Chamber of Commerce, 1 Old Hall St, Liverpool, 7 p.m.

Inst. of Fuel (London). "Coal Research Problems and their Industrial Implications." R. L. Brown. Instn. of Civil Engrs., Great George St, S.W.1, 5.30 p.m.

I.E.S. (Newcastle). "Airport Lighting." H. M. Ferguson. King's College, College Rd, 6.15 p.m.

I.E.S. (Swansea). "X-Rays in Medicine and Industry." K. Rawlings. Elect. Offices, The Kingsway, 6.30 p.m.

THURSDAY, 5 JAN.

I.E.E. (London). "Highland Water Power—Developments of N. of Scotland Hydro-Electric Board." The late T. Lawrie. (To be read by officer of the Board.) Savoy Place, W.C.2, 5.30 p.m.

British Instn. of Radio Engrs. (London). "Domestic Tape Recording Applications, especially Stereophonic Reproduction." M. B. Martin and D. L. A. Smith. School of Hygiene, Keppel St, W.C.1, 6.30 p.m.

British Instn. of Radio Engrs. (N. Western). "Radio and TV Interference—Its Growth and Effects." M. Smith. College of Technology, Sackville St, Manchester, 6.30 p.m.

Chelmsford Engineering Soc. "Exploration of Ionosphere by Radio and Other Methods." G. Millington. Hoffmann's Hall, 7.30 p.m.

I.E.S. (Cardiff). "X-Rays in Medicine and Industry." K. Rawlings. Elect. Offices, The Hayes, 5.45 p.m.

I.E.S. (Glasgow). "Lighting Problems in Coal Industry." W. Rochester. 39 Elmbank Cres, 6.30 p.m.

I.E.S. (Nottingham) Members' Night. Informal discussion on 1955 meeting of International Commission on Illumination. Elect. Offices, Smithy Row, 6 p.m.

FRIDAY, 6 JAN.

I.E.E. (London) and Instn. of Mechanical Engrs. "Power Station Auxiliary Plant." G. F. Kennedy and E. J. Hutchinson. 1 Birdcage Walk, S.W.1, 5.30 p.m.

Manchester Assoc. of Engrs. "Polythene and its Uses." A. Renfrew. Engineers' Club, Albert Sq, 6.45 p.m.

Inst. of Fuel (S. Wales). "Atomic-energy Generation." E. J. Bowen. At Port Talbot.

I.E.E. (N. Western). Christmas Lecture for schoolchildren: "Electric Traction." R. Brooks, College of Technology, Sackville St, Manchester, 3 p.m.

I.E.S. (Bath and Bristol) Members' Night at Royal Hotel, Bristol, 7 p.m.

SATURDAY, 7 JAN.

I.E.E. (N. Western). Christmas Lecture for schoolchildren: "Electric Traction." R. Brooks, Royal Tech. College, Peel Park, Salford, 3 p.m.

Birmingham Electric Club. 12th annual Christmas Party. Grand Hotel, 3 p.m.

That the homely thrush, gladdest of garden songsters, is also in the distribution business has long been known to ornithologists. With his beak he carries seeds wherever he goes, and even when he "strops" his beak on a shrub or tree after lunch, the process of distribution is continued.

At HENLEY's, the process of electrical distribution is more recent but less haphazard. With strategically placed branches throughout the land—with time-tried equipment and considerable practical experience, HENLEY's offer to authorities and industries a reliable, comprehensive and speedy service.

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CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

COUNTY BOROUGH OF OLDHAM
LIGHTING COMMITTEE

TENDERS are invited for the supply and erection of Concrete Lamp Columns and the supply of Electric Lanterns for Group A lighting in accordance with a specification which may be obtained on application to Mr. C. Worswick, Lighting Superintendent, Gas Street, Oldham.

No tender will be accepted unless it is (*a*) received in a plain sealed envelope which shall not bear any mark or name indicating the sender; (*b*) endorsed "Tender for Lighting Equipment," and (*c*) addressed to the Chairman of the Lighting Committee, c/o The Superintendent, Lighting Department, Gas Street, Oldham, to be delivered not later than 16 Jan., 1956.

The lowest or any Tender will not necessarily be accepted.

The Contract will be subject to the Standing Orders of the Council with respect to Contracts.

EDWARD HAINES,
16 Dec., 1955. Town Clerk.
(W 311)

COUNTY BOROUGH OF SWANSEA
TENDERS FOR MATERIALS AND HAULAGE

TENDERS are invited for the undermentioned for a period of twelve months from 1 Apr., 1956:

Bunting	Lamp Pillars, Steel
Bitumastic Macadam	Lamp Pillars, Concrete
Bricks	Limestone
Brooms	Manhole covers and frames
Brushes for Motor Sweeper (Refills)	Mortar
Cement	Oils (Lubricating) and Paraffin
Concrete Kerb	Petrol and Diesel Oil
Concrete Paving	Pipes (Salt Glazed)
Concrete Tubes, etc.	Public Lighting Equipment
Concreting Materials	Rubber Hose Pipe, and Gloves
Electric Cable (Street Lighting)	Sand and Gravel
Electric Lamps	Slag and Ashes
Engineering Supplies (Bolts, Packing, Tarpaulins, etc.)	Tar or Proprietary Compounds
Granite Chippings	Tar Macadam
Gullies and Frames (C.I.)	Tools and Implements
Haulage, Motor, Day Rate	Tyres and Tubes
Haulage, Motor, Tonnage Rate	Walling Stone
Iron and Steel (Bar, Sheet and Tubes)	Waste, Cleaning Cloth, etc.

Forms of Tender and further particulars may be obtained from the Borough Engineer and Surveyor, Guildhall, Swansea.

Tenders, in envelopes sealed and endorsed "Tender for ....," but which must not bear any name or mark indicating the sender, must be deposited with the undersigned, either by hand (and receipt obtained) or by registered post, on or before 28 Jan., 1956.

The lowest or any tender will not necessarily be accepted. T. B. BOWEN,
The Guildhall, Town Clerk.
Swansea.
Dec. 1955. (W 312)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

SOUTHERN ELECTRICITY BOARD
ASSISTANT ENGINEER (MAINTENANCE AND OPERATION)

GREENFORD DISTRICT of No. 1 (Southall) Sub-Area. Salary N.J.B. Class F, Grade 12, £582. 15s. per annum (inclusive of London Allowance) rising to £630 per annum inclusive. N.J.B. Conditions of Service.

The duties of the post will be to assist generally with the maintenance and operation of H.V. and L.V. overhead and underground distribution systems working at voltages up to 11,000. Sound technical training and experience, preference will be given to those applicants who possess suitable technical qualifications. The appointment may involve standby duties.

The successful candidate for the above appointment will be required to contribute to the C.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2/6 Windmill Lane, Southall, Middlesex, and returned to him, in envelopes suitably endorsed, not later than 13 Jan., 1956. (W 315)

CENTRAL ELECTRICITY AUTHORITY
North West, Merseyside and N. Wales Division

VACANCY No. E.321/465/T (Amended). —SHIFT CHARGE ENGINEER, Dolgarrog Hydro-Electric Generating Station. Salary £675/£720 (D.7). Experience in the operation of hydro-electric generating plant would be an advantage.

Vacancy No. E.321/471/T.—STATION SHIFT CONTROL ENGINEER, Connah's Quay Generating Station, near Chester. Salary £675/£720 (G.10).

Vacancy No. E.321/472/T. — SHIFT CHARGE ENGINEER, Buccleugh St Generating Station, Barrow. Salary £675/£720 (D.7).

Vacancy No. E.321/473/T. — SHIFT CHARGE ENGINEER, Chadderton "B" Generating Station, near Manchester. Salary £790/£850 (G.7).

Vacancy No. E.321/474/T.—STATION SHIFT CONTROL ENGINEER, Bolton Generating Station. Salary £675/£720 (G.10).

Vacancy No. E.321/484/T. — SHIFT CHARGE ENGINEER, Bromborough Generating Station, Port Causeway, Bromborough. Salary £840/£900 (H.7).

Applications to Divisional Secretary, Central Electricity House, 825 Wilmslow Rd, Manchester 20, before 6 Jan., 1955. Quote vacancy No. (W 325)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

THE ATOMIC WEAPONS RESEARCH ESTABLISHMENT
Aldermaston, Berkshire

requires: ASSISTANT EXPERIMENTAL OFFICERS.

Post (*a*) Ref. 847/49. To assist in a section advising on the use of the most suitable electronic components for a wide range of equipments and to carry out climatic and other tests on components. Liaison with other Branches of the Establishment and with outside manufacturers forms part of the work. Previous experience of climatic testing and familiarity with Government specifications and test procedure would be an advantage.

Post (*b*) Ref. 848/49. To assist in the design, construction and testing of a wide range of instruments used in the industrial application of electronics and also the design of test equipment. Previous experience in the above work and a knowledge of high voltage work and/or plastics would be an advantage.

For both posts candidates should possess H.S.C. (Science) or equivalent.

Salary: £330 (at age 18)—£718 per annum (for women over 21 years of age the rates are slightly lower at present).

Contributory Superannuation Scheme. Married officers now living outside the Establishment's transport area will be eligible for housing on one of the Authority's estates (or alternatively assistance towards legal expenses incurred in house purchase will be available); until housed a lodging allowance may be payable.

Requests for application forms by Postcard to Senior Recruitment Officer at the above address, quoting the appropriate reference number. (W 316)

SOUTH EASTERN ELECTRICITY BOARD
ASSISTANT DISTRICT ENGINEER
Twickenham and Richmond District

SALARY £755 x £15—£800 per annum plus London Allowance under N.J.B. Class F, Grade 7. Superannuable. Applicants of at least H.N.C. standard, should have had responsible experience in the planning of and estimating for network extensions and reinforcements including substations.

ASSISTANT DISTRICT ENGINEER
Twickenham and Richmond District

Salary £595/£640 per annum plus London Weighting under N.J.B. F.11. Superannuable. Applicants should hold O.N.C. and hold, or be studying for H.N.C. Applicants should have experience of A.C. and D.C. underground distribution systems, including substations.

ASSISTANT ENGINEER
Guildford District

Salary £635 x £15—£680 per annum under N.J.B. Class E, Grade 9. Superannuable. Applicants should hold Higher National Certificate in Electrical Engineering or its equivalent and have had practical experience in construction, operation and maintenance of underground and overhead distribution systems.

Applications for these three posts, naming 2 referees, to C. W. Hughes, B.SC., M.I.E.E., Surrey Manager, SEEBoard, Rough Rew, Horsham Rd, Dorking, by 11 Jan., 1956.

SHOWROOM ASSISTANT (MALE)
Twickenham and Richmond District

Salary £170/£410 or £190/£495 per annum plus London Weighting, according to age, educational qualifications and experience. Superannuable. A knowledge of electrical apparatus and experience in dealing with consumers' enquiries an advantage. The person appointed must be prepared to work in any of the Twickenham and Richmond district showrooms.

Applications to J. D. Parkinson, A.M.I.E.E., A.I.MECH.E., Twickenham and Richmond Manager, SEEBoard, 42 York St, Twickenham, by 11 Jan., 1956.

A. L. BURNELL,
Secretary.
(W 319)

CENTRAL ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

SHIFT CHARGE ENGINEER
DRAKELOW POWER STATION

Vacancy No. 241/55/ET

Applications are invited from suitably qualified Engineers having had operating experience with large capacity high pressure turbo-alternators and pulverised fuel fired boilers. Applicants should be in possession of technical qualifications admitting to corporate membership of the Institution of Electrical Engineers and/or Institution of Mechanical Engineers. Apprenticeship at a large manufacturing works will be an advantage.

Salary will be in accordance with Class J, Grade 7 (£900 x £25—£975 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 18 Jan., 1956.

ASSISTANT SHIFT CHARGE ENGINEER
DRAKELOW POWER STATION

Vacancy No. 242/55/ET

Applicants should have a technical qualification up to H.N.C. standard and have received a sound engineering training followed by operating experience with large capacity high pressure plant, preferably in conjunction with P.F. Boilers.

Salary will be in accordance with Class J, Grade 9 (£790 x £10—£850 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 18 Jan., 1956.

THIRD ASSISTANT ENGINEER (SYSTEM PLANNING) TECHNICAL DEPARTMENT, DIVISIONAL H.Q.

Vacancy No. 240/55/ET

Applicants should preferably hold an Electrical Engineering Degree or have attained the Higher National Certificate standard in Electrical Engineering. Preference will be given to candidates who have had experience of switchgear and protective gear systems.

Candidates should have had experience in the design, layout and development of 132 kV and 33 kV systems, and knowledge of the principles of modern protective gear equipment and its application. Experience in the calculation of fault levels, preparation of load flow diagrams, relay settings and operation of D.C. short circuit and load flow calculators is desirable.

Salary will be in accordance with Class AX/DX, Grade 4 (£750 x £25—£950 per annum) of Schedule C of the National Joint Board Agreement.

Closing date for receipt of applications, 18 Jan., 1956.

FOURTH ASSISTANT ENGINEER (SECTION)
STAYTHORPE TRANSMISSION SECTION

Vacancy No. 227/55/ET

The Section contains extensive 275 kV and 132 kV equipment and the candidates must have had wide experience in the maintenance and operation of 132 kV lines and substations in a Transmission Section.

Preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary will be in accordance with Class AX/DX, Grade 6 (£600/£785 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Jan., 1956.

SHIFT CONTROL ENGINEER
STAYTHORPE POWER STATION

Vacancy No. 237/55/ET

Applicants should have had a sound training and practical experience in a modern Power Station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be an advantage.

Salary will be in accordance with Class K, Grade 10 (£790 x £20—£850 per annum) of the National Joint Board Agreement.

A house will be available for the successful applicant, if required.

Closing date for receipt of applications, 12 Jan., 1956.

SECOND ASSISTANT ENGINEER (MECHANICAL) GENERATION (CONSTRUCTION) DEPARTMENT

continued in next column

continued from previous column

Vacancy No. 239/55/ET

Preference will be given to applicants who hold a degree in Mechanical Engineering, are Corporate Members of the Institution of Mechanical Engineers or possess equivalent qualifications. Some electrical training and experience will be a recommendation.

They should have some experience in the design and construction of turbo-alternators, boilers, coal and ash handling plant, high pressure steam and water piping and other ancillary work.

Some knowledge of the preparation of specifications and estimates and a knowledge of thermo-dynamics and hydraulics will be an advantage.

Salary will be within Schedule C, Class AX/DX, Grade 2 (£950/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 18 Jan., 1956.

These appointments will be pensionable within the terms and provisions of the Central Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.

19 Dec., 1955. (W 317)

LONDON ELECTRICITY BOARD

ENGINEERS (OPERATION AND MAINTENANCE)

APPLICATIONS are invited for the following positions in the Board's Northern Sub-Area.

ISLINGTON DISTRICT (REF: V/2074/T)

Applicants should have had a sound technical education up to at least Higher National Certificate standard, preferably being corporate members of the I.E.E., and possess a practical experience of all branches of engineering work associated with the organisation of a District distribution department, particularly in regard to mains and substation work on both single- and three-phase systems.

The post is graded under Schedule "A" of the National Joint Board agreement as Class F, Grade 7—£792. 15s. per annum rising to £840 per annum, inclusive of London Allowance.

CITY DISTRICT (REF: V/2071/T)
FINSBURY/SHOREDITCH DISTRICT
(REF: V/2087/T)

Applicants should have had a sound technical education and should have had practical experience in all branches of engineering work associated with the organisation of a District distribution department, particularly in regard to mains and substation work on both a.c. and d.c. systems.

The posts are graded under Schedule "A" of the National Joint Board agreement as Class F, Grade 9—£708. 15s. per annum rising to £756 per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46/7 New Broad St, London, E.C.2. Please quote appropriate reference No. of vacancy preferred. (W 309)

CENTRAL ELECTRICITY AUTHORITY

require THIRD ASSISTANT ENGINEER at Headquarters in London, to assist an engineer responsible for co-ordinating construction work at a number of power stations. Knowledge of modern power station work is essential and practical experience of site work would be an advantage. Candidates should have qualifications equivalent to Graduate of the Institution of Electrical Engineers or Institution of Mechanical Engineers standard. Salary within N.J.B. Grade 3, £908/£1,125 per annum inclusive. Applications stating age, qualifications, experience, present position and salary to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 14 Jan., 1956. Quote ref. AE/720. (W 304)

CITY OF SALISBURY: SOUTHERN RHODESIA

APPLICATIONS are invited for the following fixed establishment post in the Electricity Department of the above Municipality:

ASSISTANT SHIFT CHARGE ENGINEER (salary scale £1,150 x £50—£1,350 per annum). Applicants must have completed a technical education to the standard of Graduate of the Institution of Electrical Engineers or the Institution of Mechanical Engineers, and must have had experience in the operation of steam power station plant, including control room duties (preferably on an interconnected system), and the running-up of steam turbine plant.

The above appointment is subject to Council's Service and Leave Regulations, which will be made available for inspection by selected candidates at the offices of the undersigned. The salary payable will commence at the minimum of the grade rising by annual increments to the maximum salary of the grade (no cost of living or other allowances are payable).

The successful candidate must be able to comply with the regulations of the Southern Rhodesia Immigration Authorities, and will be required to submit a satisfactory medical certificate.

Applicants, who should be not more than 45 years of age, are required to submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received, marital state, age, place of birth and nationality. Copies of not more than three recent testimonials may be included.

Canvassing, directly or indirectly, will be a disqualification.

Applications, suitably endorsed on the cover, must reach the office of the undersigned on or before 14 Jan., 1956. Airmail paper should be used.

DAVIS AND SOPER LTD.,
Agents to the City Council of Salisbury, Southern Rhodesia.

52 and 54 St. Mary Axe,
London, E.C.3.

15 Dec., 1955. (W 289)

CENTRAL ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following superannuable post in the Great Yarmouth, Norfolk, district:

THIRD ASSISTANT ENGINEER (ELECTRICAL)

Salary Class AX/DX, Grades 4-3, £750/£1,090 per annum.

The appointment will be within one of the above grades depending upon the experience and qualifications of the successful applicant.

The applicant appointed will be required, under the direction of the Resident Engineer, to supervise the construction and installation of the electrical plant consisting of four 60 MW generating units and their auxiliaries.

Applications stating age, experience, qualifications and present position should be forwarded to the Controller, Central Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, by 7 Jan., 1956.

W. N. C. CLINCH,
Controller.
(W 308)

AIR MINISTRY
Works Designs Branch

requires in London and Provinces (with liability for overseas service ELECTRICAL ENGINEERING DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage. Salaries up to £850 per annum starting pay dependent on age, qualifications and experience. Paid overtime. Long term possibilities with promotion and pensionable prospects. Four weeks' leave a year. Natural born British subjects. Write stating age, qualifications, employment details, including type of work done, to any Employment Exchange, quoting Order No. Borough 2307. (W 41)

CAMEROONS DEVELOPMENT CORPORATION

require for service in the British Cameroons (Nigeria) an ELECTRICAL SUPERVISOR. Candidates should have served an indentured apprenticeship in the electrical trade and have attained foreman status. Considerable experience of refrigerators and refrigerating plant is essential as duties will include the maintenance of approximately two hundred refrigerators and two cold stores and several air conditioning units. Age limits 25-40. Commencing salary £850/£900 in an annually incremental scale rising to £1,200 with first class passages to and from the Cameroons for officers and their wives. Free accommodation (equipped with heavy furniture) during residence in the Cameroons, together with a reasonable allowance of lighting and fuel. An Outfit Allowance of £80 is payable on first appointment. Children's Allowances of £75 each are payable up to a maximum of two. Officers are required to contribute 10% of their salary to a Provident Fund, the Corporation contributes 15%. Tours of about eighteen months with one week's leave on full pay for each completed month of service if the officer is returning for further service, otherwise half the amount of leave.

Applications giving full particulars in writing, to Rubber and Mining Agencies Ltd., CDC/ES, 52 Leadenhall St, London, E.C.3. Acknowledgment will only be made to applicants selected for further consideration. This appointment is exempt from the requirements of the Notification of Vacancies Order 1952. (W 310)

AIR MINISTRY

require STATION ENGINEERS (G.D.) and STATION ENGINEERS (Mech.) at Royal Air Force and Ministry of Transport and Civil Aviation Stations. Qualifications required (*a*) Ordinary National Certificate in Electrical or Mechanical Engineering or show that an equivalent standard of technical education has been reached. (*b*) recognised apprenticeship in electrical or mechanical engineering with firm or establishment of good repute. (*c*) three years' employment in electrical or mechanical engineering preferably on operation and maintenance of mine, factory or workshop plant and services. Preference given to applicants who have had supervisory duties subsequent to (*b*) and (*c*). Work will consist of installation, operation and maintenance of high and medium voltage electrical distribution systems, electrical installations, generating plant, steam and hot water heating systems and miscellaneous works plant tools and equipment. Commencing salary according to age, qualifications and experience on range from £565/£812. Lodging allowance payable in certain circumstances. Liability for tours of duty overseas for which special allowance payable in addition to higher salary. Appointments non-pensionable. Only natural-born British subjects. Write, giving age, full details of qualifications and experience to AB.1255, London Appointments Officer, Ministry of Labour and National Service, 1-6 Tavistock Sq, W.C.1. No original Testimonials should be sent. Only candidates selected for interview will be advised. (W 212)

CENTRAL ELECTRICITY AUTHORITY
South Wales Division

Vacancy No. 146/55

APPLICATIONS invited for superannuable N.J.B. appointment as DEPUTY STATION SUPERINTENDENT at Llynfi Power Station.

Salary: Grade G.3, £1,035 x £30—£1,125 per annum.

Applicants should preferably be Corporate Members of the Institution of Mechanical and/or Electrical Engineers and have had considerable experience in the operation, maintenance and administration of a modern generating station including experience of pulverised fuel.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 9 Jan., 1956. (W 320)

AIR MINISTRY

require MECHANICAL and ELECTRICAL ENGINEERS in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation stations. Appointments in two grades (*a*) Main Grade, salary scale £1,182/£1,527, (*b*) Assistant Grade £761/£1,182. Starting pay according to qualifications and experience. Salaries somewhat lower in provinces. Appointments non-pensionable but with long-term possibilities. Special allowance up to £1,500 a year, according to location, payable in addition to salary during overseas service. Candidates normally must be natural-born subjects of natural-born British parents and age 25 or over. Minimum qualifications and experience for both grades of posts: (i) (*a*) University degree or equivalent diploma in electrical and/or mechanical engineering with at least 2 years' apprenticeship; or (*b*) Graduate or Corporate Member of I.E.E. with at least 3 years' apprenticeship; or (*c*) Graduate or Corporate Member of I.Mech.E., appreciable electrical engineering experience with at least 3 years' apprenticeship. (ii) Have been employed for minimum of three years with well-established engineering concern and gained wide experience in both electrical and mechanical engineering practice. Application forms quoting reference D240/5A from M.L.N.S., Technical and Scientific Register (K), 26 King St, London, S.W.1. (W 63)

CENTRAL ELECTRICITY AUTHORITY
Midlands Division

ASSISTANT MAINTENANCE ENGINEER (Mechanical) is required at Hams Hall "B" Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule "A," Grade K8, £900/£975 per annum.

A sound technical training and practical experience in modern power station mechanical maintenance is required, and the possession of appropriate technical qualifications will be an advantage.

Apply, quoting vacancy No. 173MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 2 Jan., 1956. (W 305)

CENTRAL ELECTRICITY AUTHORITY
North Eastern Division

APPOINTMENT OF DEPUTY POWER STATION SUPERINTENDENT, DUNSTON "A," DUNSTON "B" AND BLAYDON POWER STATIONS

APPLICATIONS are invited for the appointment of Deputy Power Station Superintendent at the above-mentioned group of Power Stations.

Applicants should have received a thorough technical and practical training followed by wide experience in the operation and maintenance of Generating plant, and should have also held a position of responsibility involving the control of technical, operating and administrative staffs.

The salary for the appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule "A," Grade 3, Class K (£1,295/£1,400 per annum).

Forms of application may be obtained from Divisional Establishment Officer, Central Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, to whom they should be returned to arrive not later than 7 Jan., 1956. (W 298)

KENT COUNTY COUNCIL

APPLICATIONS are invited for:

(1) SENIOR ELECTRICAL ENGINEER. Salary £750/£900. Applicants should be Corporate Members of the Institution of Electrical Engineers and have experience in the electrical equipment of buildings.

(2) ELECTRICAL ENGINEER. Salary £650/£775. Applicants should be Graduate Members of the above Institution and have similar experience.

Application forms from County Architect, Springfield, Maidstone. Closing date 12 Jan., 1956. (W 273)

CENTRAL ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following posts:

GENERAL ASSISTANT ENGINEER
CLIFF QUAY GENERATING STATION

Salary Class K, within the range of Grades 18/15, £475 x £15—£640 per annum.

GENERAL ASSISTANT ENGINEER
LITTLE BARFORD GENERATING STATION

Salary Class G, within the range of Grades 15/14, £475 x £15—£560 per annum.

The duties of the successful applicant will include assisting in the Control Room on shift and other operation and investigation duties. Preference will be given to applicants who have had previous experience in a Generating Station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent.

Applications stating age, qualifications and experience should be sent to the Controller, Central Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, by 7 Jan., 1956.

W. N. C. CLINCH,
Controller.
(W 306)

PORT OF LONDON AUTHORITY

THE Port of London Authority invite applications for the position of LEADING TECHNICAL ASSISTANT (Electrical) in the Drawing Office of the Authority. The scale of pay is £600 per annum rising subject to certain conditions by annual increments of £25 to £725 per annum, with the commencing rate according to qualifications and experience.

Applicants, who must be British Subjects and have obtained the Ordinary National Certificate in Electrical Engineering, should have had experience in the layout of distribution networks and substations, building, wiring and lighting schemes, and also motor and control gear schematic and wiring diagrams.

The successful applicant will be required to join the Authority's contributory superannuation scheme. In certain cases existing pensionable service is transferable.

Application forms may be obtained from the Establishment Officer, Port of London Authority, Trinity Sq, London, E.C.3. (W 313)

A LARGE industrial Company requires an ASSISTANT ENGINEER who has experience in all aspects of industrial coal fired boiler plants and their associated machinery.

A real understanding of modern boiler design and practice is essential.

Candidates should send full particulars of qualifications, age and experience to—Box No. 5079, Electrical Times. (W 269)

ASSISTANT ENGINEER required for Overhead Line Contracts, Inverness Area. Good salary plus subsistence if applicable. Apply: B. French Limited, Pike Mills, Green St, Kidderminster. (W 220)

COURTAULDS LIMITED require an ENGINEER for their Engineering Headquarters, Coventry, to work in a specialised section on specification, selection and starting up of new boiler plants: the section is also responsible for investigating, testing and advising on the use of existing boiler plant and associated auxiliary machinery.

A sound basic knowledge of the principles of combustion as applied to modern boiler practice and experience of coal firing on chain-grate stokers are essential. Optimum age 40.

Candidates should write for a detailed form of application to the Director of Personnel, Courtaulds Limited, 16 St. Martins-le-Grand, London, E.C.1, quoting reference number B.31. (W 268)

DESIGN ENGINEER required for the development of outdoor-type high voltage isolating switches and fuse gear for 11 kV and above. Applicants must have had good Drawing Office training and experience in the design of similar equipment. Write giving particulars of experience, age and salary required to—Box No. 5083, Electrical Times. (W 271)

COURTAULDS LIMITED

require an additional ELECTRICAL ENGINEER for their Electrical Engineering Headquarters in Coventry.

The work will be with a section covering a wide range of activities from telecommunications to power consumption and commissioning tests on all types of industrial machinery and switchgear.

Applicants should have a University degree or H.N.C. in Electrical Engineering. An apprenticeship or some previous works experience will be an advantage.

Candidates should write for a detailed form of application to the Director of Personnel, Courtaulds Limited, 16 St. Martins-le-Grand, London, E.C.1, quoting reference number B.32. (W 227p)

DRAUGHTSMEN. Senior and Junior accustomed to the design of all types of power and lighting installations for Industrial and Business premises. Progressive firm offering good working conditions, salary and Pension Scheme. Apply giving details of training and experience to—Box. No. 5089, Electrical Times. (W 307)

ELECTRIC CABLE JOINTER required for research work on aluminium cable jointing. No previous knowledge of aluminium required. Position carries responsibility and prospects of travel for demonstraton purposes. Pensions scheme in operation. 5-day week. Apply: The Director, Aluminium Laboratories Ltd., Southam Rd, Banbury, Oxon. (W 302)

ELECTRICAL ENGINEERS. The opportunity occurs for an Electrical Engineer, experienced in all types of lighting and power installations in buildings, to take charge of old established London contracting business having finance available for expansion. First-class opportunity for progressive man. Applications will be treated in strict confidence.—Box No. 5073, Electrical Times. (W 223)

ELECTRICIAN. First Class. Maintenance and Jobbing for West End Contractors. —Box No. 5087, Electrical Times. (W 280)

ENGINEER SURVEYOR required for inspection of Electrical Plant. H.N.C. with practical experience essential. Salary £600 per annum rising after 10 years to £850. Pension (non-contributory). Apply: Manager, Engineering Department, General Accident Assurance Corporation, 99 Aldwych, London, W.C.2. (W 303)

LANCASHIRE DYNAMO AND CRYPTO, LTD., Trafford Park, Manchester, 17, require the undermentioned additional staff:

TECHNICAL ASSISTANTS required for Service Department. Applicants should have good technical background (preferably H.N.C. standard) conversant with Electrical Rotating Machinery and able to handle correspondence.

5-day week. Pension scheme. All applications will be treated with the strictest confidence and should be addressed to the General Manager. (W 299)

OPPORTUNITY IN ELECTRICAL CABLE MANUFACTURE

MERSEY CABLE WORKS LTD., has vacancies in production, technical and commercial department. Able and ambitious men aged 21-40, with experience in the industry and who desire to exploit the technological advances now being made in this field, are invited to make application for an exploratory interview, which can be arranged in London, Birmingham or Liverpool. The Company, as a member of the Tube Investments Group, offers all the advantages and scope of a large industrial undertaking.

Write giving full details of background and interests to The Managing Director, Mersey Cable Works Ltd., Boodle, Liverpool. 20. (W 314p)

GRANADA TV NETWORK LIMITED require a BUYER able to analyse costs and investigate markets for new materials and methods. Some knowledge of electrical furnishing or electronic trades an advantage. Experience as buyer not essential. Write details age, previous experience, salary required to Managing Director, 36 Golden Sq, W.1. (W 323)

SALES REPRESENTATIVE for North East Coast based on Newcastle upon Tyne area. Electrical installation accessories, L.T. distribution equipment and switchgear. Technically qualified, and sales experience. Car driving and correspondence. Medical examination. Salary, commission, contributory pension, expenses, and car provided. Informative letters only please and photograph, in confidence, to Sales Director, Ashley Accessories Ltd., Ulverston, Lancs. (W 297)

SALES ENGINEERS required for preparation of Switchgear and Transformer Tenders, previous experience essential. Minimum qualifications. Higher National Certificate. Applications giving full particulars of age, experience, and qualifications to—Box No. 5085, Electrical Times. (W 278)

SALES ENGINEER required as personal assistant to Sales Director for Motor Control Gear company in N.E. London. Excellent prospects for applicant with good electrical training, personality and some experience. Duties include interviewing customers and preparation of tenders and sales literature. Write, stating age, experience and salary required.—Box No. 5067, Electrical Times. (W 177)

SURVEYOR required, conversant with Surveying and Profiling of Overhead Line Routes. Good salary and subsistence. References required. Apply: B. French Limited, Pike Mills, Green St, Kidderminster, or 35 Haugh Rd, Inverness. (W 259)

SURVEY AND WAYLEAVE OFFICERS required in connection with H.V. and L.V. Overhead Lines in Midlands. Apply in first instance to—Box No. 5091, Electrical Times. (W 318)

TECHNICAL ASSISTANT required for drafting of Electrical Regulations, Codes of Practice, etc. Graduate I.E.E. or corresponding qualification necessary, also experience in committee work and drafting of reports. Commencing salary £600/£675, depending upon age and qualifications. Progressive post. Pension Scheme.—Box No. 5093, Electrical Times. (W 322)

TECHNICAL SALES REPRESENTATIVE required for South West England and South Wales, connection with Architects, Hospital Boards, Local Authorities and the Trade, desirable. Able to drive. Apply in writing giving details of age, education, qualifications and experience to Sales Director, Wandsworth Electrical Manufacturing Company Limited, Albert Drive, Sheerwater, Woking, Surrey. (W 301)

THE GENERAL ELECTRIC CO., LTD., require for their Marine Organisation in London and the north of England, ENGINEER REPRESENTATIVES with or without seagoing experience and willing to study and handle a wide range of Marine equipment including heavy and light engineering communications, cable, lighting, etc.

(1) MECHANICAL AND ELECTRICAL ENGINEER, Degree standard, age 30/40 with practical experience of steam turbines and/or turbo electric machinery.

(2) ELECTRICAL ENGINEER, age 25/35, Degree or A.M.I.E.E. Standard; student or post-graduate works apprenticeship.

(3) ELECTRICAL ENGINEER, under 30, Higher National Certificate, student apprentice training.

Salary according to qualifications and experience. Apply in writing to The Staff Manager, Magnet House, Kingsway, London, W.C.2, stating age and full personal record. (W 324)

TRANSFORMER ENGINEER

Johnson and Phillips Ltd. require a senior engineer experienced in the preparation of designs for all classes of transformers up to 30 MVA, 132 kV. This is a senior staff appointment with good pension facilities, holidays and canteen arrangements.

Applications stating age, training, experience and salary required should be addressed to the

Employment Manager,
Messrs JOHNSON AND PHILLIPS LIMITED
Victoria Works, Victoria Way, Charlton, S.E.7.

(W 321p)

TRANSFORMER TEST ENGINEER to take charge of Test Department dealing with units up to 15 MVA. Also ASSISTANT TESTER for above Department. Write, giving details of qualifications, experience and approximate salary expected, to Technical Director, Bryce Electric Construction Co., Ltd., Kelvin Works, Hackbridge, Surrey. (W 199)

WORKS MANAGER required for Motor Control Gear factory in N.E. London, with 200 employees. Excellent prospects for man with initiative and experience of modern planning methods, production and labour control. Good salary with pension and bonus scheme for applicant with suitable experience. Write to Managing Director—Box No. 5065, Electrical Times. (W 176)

WANTED

NEWTON Automatic Voltage Regulator, Admiralty pattern W.1698 required in large quantities.—Box No. 5081, Electrical Times. (W 270)

WANTED, for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. and H. Cooper Ltd., 176 Brady St, Bethnal Green, E.1. (W 1)

WANTED ROTARY CONVERTERS, any size.—Universal, 221 City Rd, London, E.C.1. (W 2)

ALWAYS BUYING Scrap Mercury, aircraft plugs, contacts, wire, foil, and all waste materials containing precious metals. Prompt service and settlement. Samples tested free. Belgrave Buyers Ltd. (E.T.), 5 Belgrave Gardens, London, N.W.8. MAI 7513. (W 225)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (W 3)

ARMATURE REWINDING service to the trade. Vacuums, Drills, Grinders, Hood Dryers, Dental Motors. Vacuum Cleaner and Drill Armatures replaced from stock 24-hour service. Every job guaranteed. All Vacuum Cleaner parts, hoses, bearings, etc., in stock for any make. Complete overhauls our specialty, Regam Electric Cleaner Service, 95/99 Park Lane, Leeds 1. (W 4)

LET US SOLVE YOUR BREAKDOWN PROBLEMS, repairs speedily carried out by experts. Collection and Delivery by our own transport. A. T. Robinson, Electrical Power Engineers, The Green, Southall, Middx. Southall 3494/5/6. (W 5)

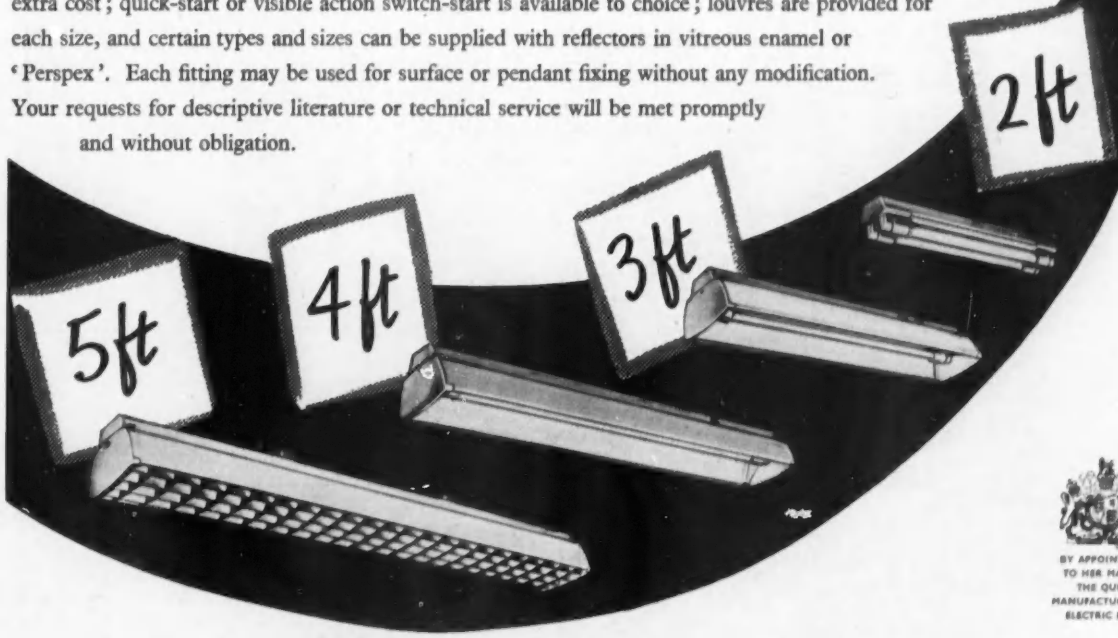
continued on page 58

Further developments

The success of Crompton 'NEW-RANGE' 5 ft. fittings has exceeded even our confident hopes. Now, in response to your requests, we have extended 'NEW-RANGE' to other sizes so that you can enjoy all the advantages of:

*** Simple installation * Easy maintenance * Standardisation of parts throughout**
*** Complete adaptability for all forms of wiring and fixing centres,**
over a wide range of designs in 5 ft., 4 ft., 3 ft. and 2 ft. models.

Over 150 different types will give you harmony in style of fittings throughout a building for GENERAL, LOCALISED GENERAL or LOCAL lighting. Finish is in top-grade 'Permawhite' enamel, at no extra cost; quick-start or visible action switch-start is available to choice; louvres are provided for each size, and certain types and sizes can be supplied with reflectors in vitreous enamel or 'Perspex'. Each fitting may be used for surface or pendant fixing without any modification. Your requests for descriptive literature or technical service will be met promptly and without obligation.



BY APPOINTMENT TO HER MAJESTY THE QUEEN MANUFACTURERS OF ELECTRIC LAMPS

Crompton *'New-Range'*

Lighting fittings for Industry

ELECTRICAL EQUIPMENT

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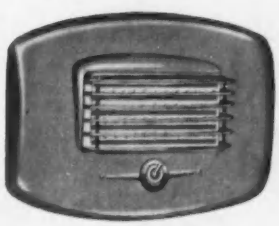

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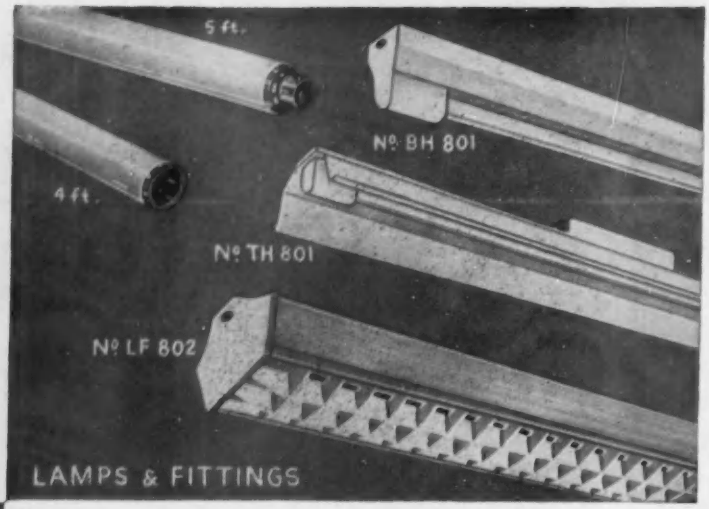

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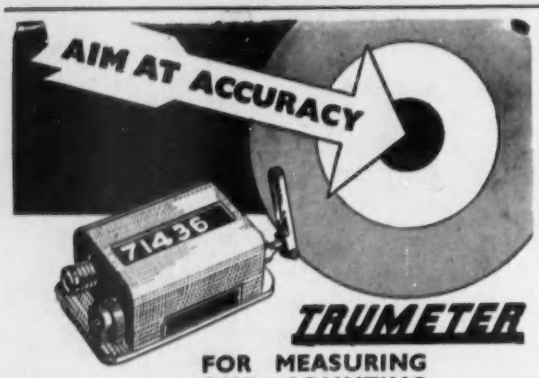

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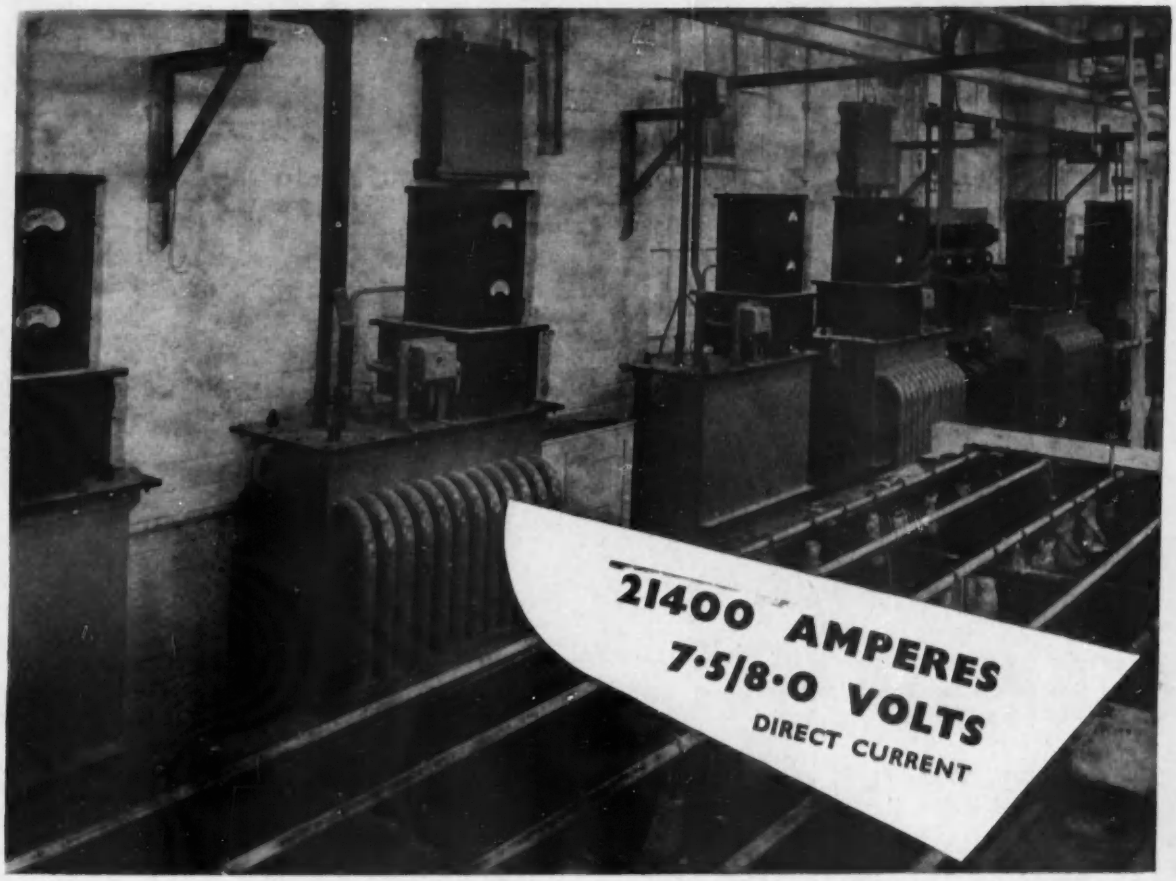

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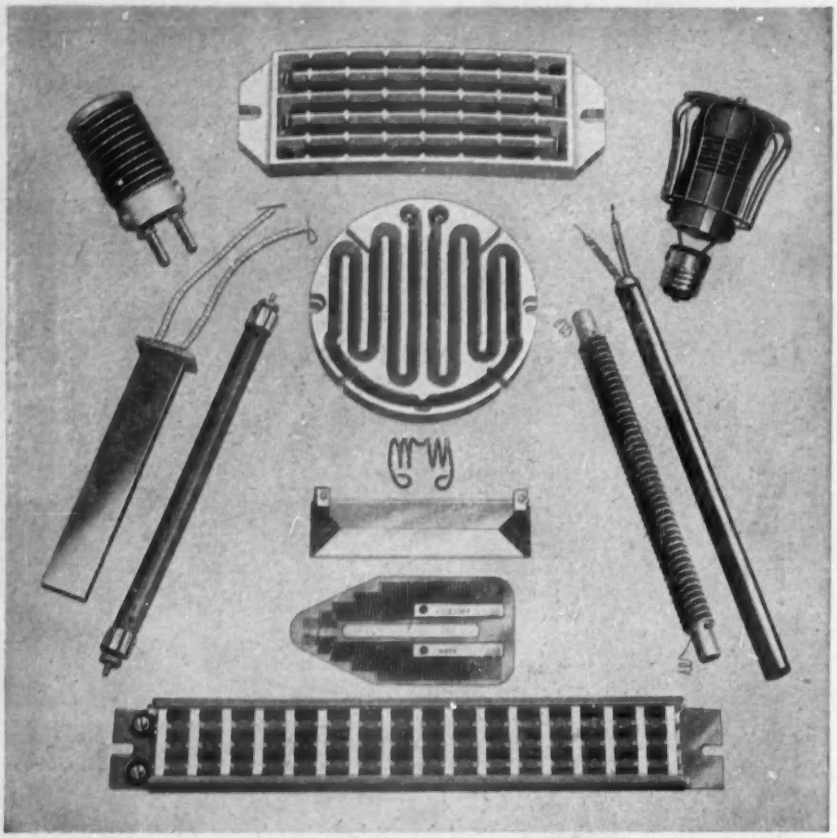

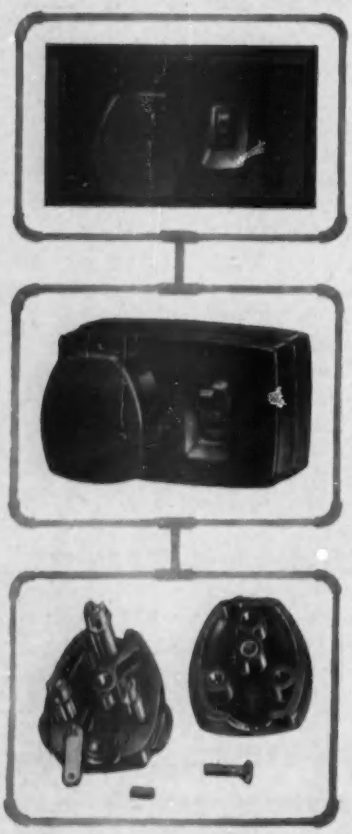

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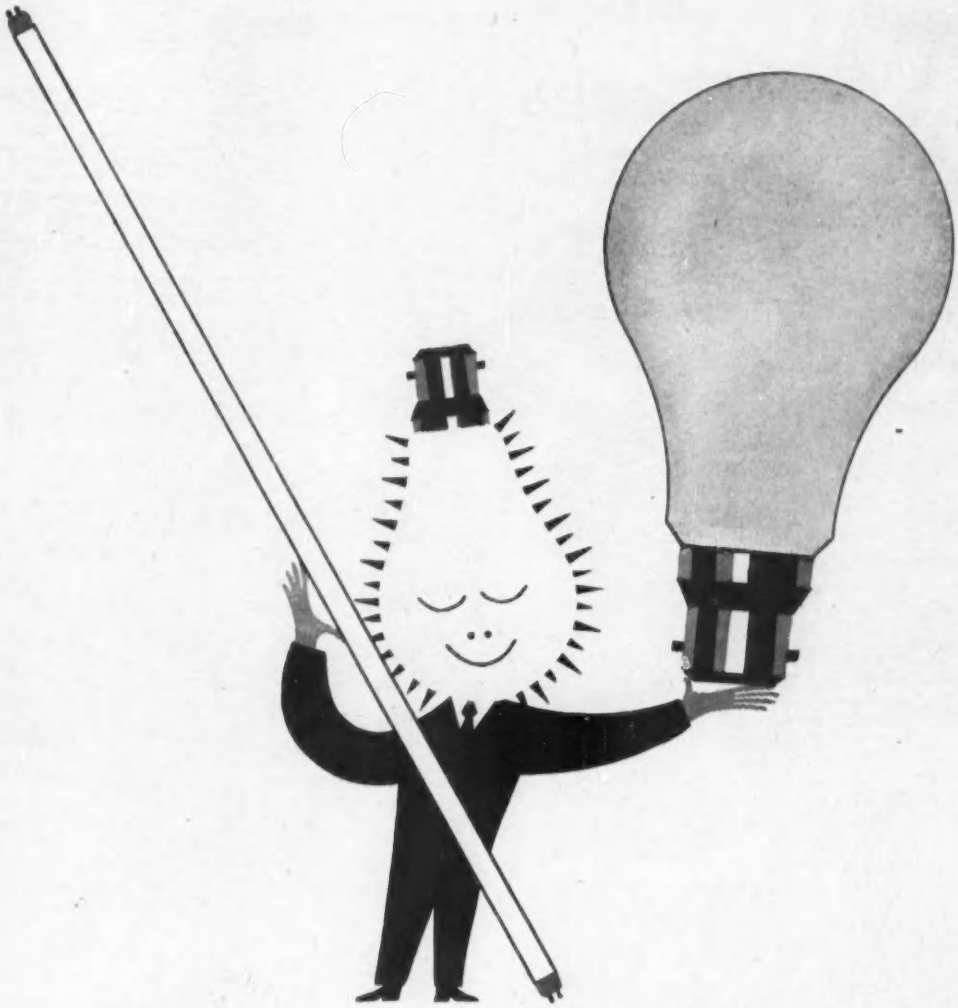

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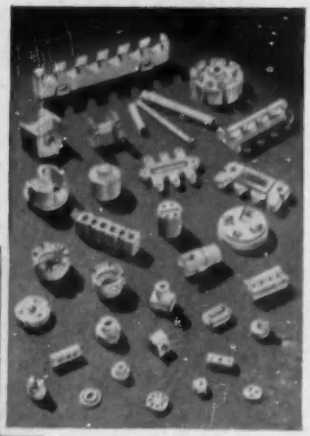

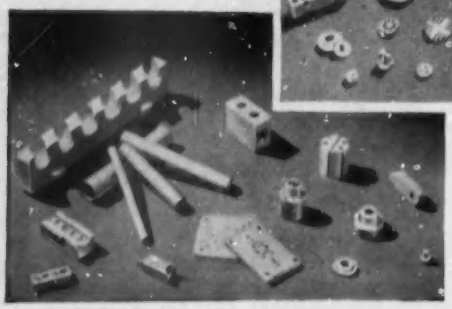

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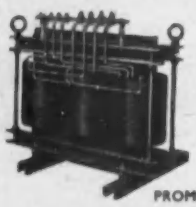

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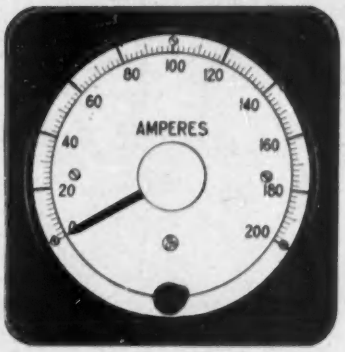

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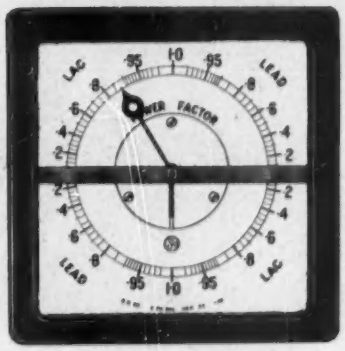

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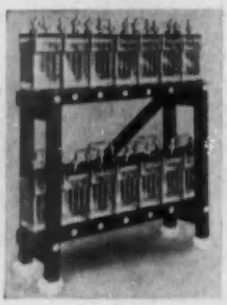

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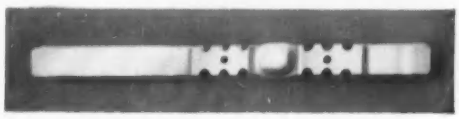

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